Known on 10/2/89 for MEMC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

IN THE MATTER OF: MEMC Electronic Materials, Inc. St. Peters Plant ST. Peters, Missouri EPA ID. MOD001700673, RESPONDENT PROCEEDING UNDER SECTION 3008(h) OF THE RESOURCE CONSERVATION AND RECOVERY ACT, AS AMENDED BY THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984, 42 U.S.C. § 6928(h)	FINAL ADMINISTRATIVE ORDER ON CONSENT Docket No. VII-89-H-0041

I. JURISDICTION

A. This Final Administrative Order on Consent (Consent Order) is issued pursuant to the authority vested in the Administrator of the United States Environmental Protection Agency ("EPA") by § 3008(h) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act of 1976 ("RCRA"), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6928(h). The authority vested in the Administrator has been delegated to the Regional Administrators by EPA Delegation Numbers 8-31 and 8-32, dated April 16, 1985, and has been further delegated by the Regional Administrator for Region VII to the Director of the Waste Management Division of the EPA ("Complainant"). This

Administrative Consent Order is issued to MEMC Electronic Materials, Inc. (hereinafter "MEMC" or "Respondent"), the owner and operator of a manufacturing facility located at 501 Pearl Drive (City of O'Fallon) St. Peters, Missouri 63376 (hereinafter the "Plant").

B. By entering into this Consent Order, Respondent consents to and agrees not to contest the following:

1. EPA's jurisdiction to issue this Order and to enforce its terms.

2. EPA's jurisdiction either to compel compliance with this Consent Order in any enforcement proceeding, whether administrative or judicial, or to impose sanctions for violation of this Consent Order.

3. The findings of fact, conclusions of law and determinations set forth in Articles IV. and V. respectively of this Consent Order, but solely for purposes of performance and enforcement of this Consent Order and for no other purpose. Respondent reserves the right to present in a subsequent proceeding more detailed, complete, recent or specific information that would question the relevance, or appropriateness of relying upon the general statements contained in paragraphs C through L of Article IV. Respondent reserves the right to contest any allegations that a violation has occurred or that facts warranting sanctions or enforcement have taken place, and to assert any facts that might mitigate such violations or sanctions.

C. This Consent Order is entered into solely to settle a dispute between Respondent and EPA. Respondent does not admit, and nothing herein shall be construed as an admission, that Respondent is liable for any costs or penalties, or that Respondent has violated any law, regulation, duty or standard of care in its past or present operation of the Plant.

D. The intentions of the Parties in entering into this Consent Order are as follows:

1. That the release of hazardous wastes and hazardous constituents from or at solid waste management units at the Plant be addressed pursuant to Sections 3004(u), 3004(v) and 3008(h) of RCRA; and

2. That the work required by this Consent Order be implemented by MEMC and that EPA will undertake any such work only if it is not being implemented by Respondent in accordance with the requirements of this Consent Order.

II. PARTIES BOUND

A. This Consent Order shall apply to and be binding upon MEMC, its officers, directors, employees, agents, successors and assigns.

B. No change in ownership of the MEMC St. Peters Plant, or change in corporate or partnership status relating to the Respondent shall in any way alter MEMC's responsibility under this Consent Order.

C. MEMC shall provide a copy of this Consent Order to all contractors, subcontractors, laboratories, and consultants

currently retained to conduct or monitor any portion of the work pursuant to this Consent Order within ten (10) working days of the effective date of this Consent Order or for any such contractors, subcontractors, laboratories, and consultants retained after the effective date of this Consent Order, within ten (10) working days of the date of such retention, and shall condition all such contracts on compliance with terms of this Consent Order.

D. MEMC shall give notice of this Consent Order to any successor in interest prior to transfer of ownership or operation of the Plant and shall notify EPA in writing as to the identity of such successor at least 60 days prior to the effective date of such transfer.

III. STATEMENT OF PURPOSE

A. This Consent Order addresses the following activities with regard to the Plant:

1. Interim Measures (IM) to mitigate potential threat to human health or the environment;

2. A RCRA Facility Investigation (RFI) to determine fully the nature and extent of any release of hazardous waste or hazardous constituents; and

3. A Corrective Measure Study (CMS) to identify and evaluate alternatives for the corrective action necessary to prevent or mitigate any migration or releases of hazardous wastes or hazardous constituents.

B. This Consent Order does not require the performance of any work beyond the IM, RFI, and CMS, and does not obligate Respondent to undertake any work to implement the corrective measure which may be identified in the CMS.

IV. FINDINGS OF FACT

A. Respondent is a corporation organized under the laws of the State of Delaware and authorized to do business in the State of Missouri.

B. Respondent is the current owner of property located at 501 Pearl Drive in the City of O'Fallon west of the City of St. Peters, in St. Charles County, Missouri (hereinafter "MEMC-St. Peters Plant" or the "Plant"). Prior to April 1, 1989, the Plant was owned and operated by the Monsanto Company. The location of the Plant is shown on Attachment I to this Consent Order.

C. Land surrounding the Plant is primarily used for industrial and agricultural purposes. There are currently fourteen (14) permanent residences within a 1 mile radius of the Plant, seven (7) of which have groundwater wells.

D. The Plant is situated in the Mississippi River Basin just north of the Mississippi River Basin/Missouri Basin groundwater divide. The bedrock that underlies the Plant is primarily Burlington-Keokuk Limestone of the Mississippian age. The Burlington-Keokuk limestones are continuous in this area and crop to the South and North of the site. The total thickness of this limestone unit varies from 0 to 240 feet, depending upon removal by erosion, where present.

E. The Burlington-Keokuk formation is composed of limestones that contain abundant bedded and nodular chert throughout the entire thickness. Bedding planes are fairly thin, with limestone usually thicker (3 to 4 feet) than the chert beds (less than 1 foot). The limestone is usually crystalline and the grains size ranges from very fine to very coarse.

F. The Burlington-Keokuk formation usually underlies gently rolling surfaces of the highlands. Where the highlands are adjacent to the floodplain, the formation is usually carved or eroded into narrow divides by present or ancient steep stream gradients.

G. Structurally, the Burlington-Keokuk Formation has been affected by the Ozark uplift. A monoclinal structure which dips to the northeast is also expressed in this Formation. Structural contours on the base of the Burlington Limestone indicate a general dip of 30 feet per mile to the northeast. Rocks of the Burlington-Keokuk and other formations in the Weldon Spring area have two distinct sets of joints, one trending northeast (N30 degrees west to N72 degrees east) and the other trending northwest (N30 degrees west to N65 degrees west).

H. Sitting on top of the bedrock underlying the Plant lies between 20 to 70 feet of clayey silt (windblown loess) and residual clays. Varying amounts of chert and limestone fragments are found in the lower residual clays. Within the unconsolidated formations, a shallow water bearing zone can be found. These formations yield minor amounts of water. The Burlington-Keokuk

aquifer directly below the unconsolidated formations yields moderate amounts of water (up to 50 gpm). Water occurs along fractures, joints and bedding planes, as well as solution openings. Water availability depends on tapping and developing these openings. It is assumed, but not proven, that the Maquoketa shale/Grassy Creek shale form the first aquitard, thus marking the bottom of the upper aquifer. These formations are approximately 340 feet below ground level.

I. Transmissivity of the uppermost aquifer is estimated to be 45 to 232 gal/day/ft. within an average transmissivity of 113 gal/day/ft.

J. Depth to groundwater at the Plant varies from 0 to 26 feet.

K. Recharge of the aquifer is through precipitation, seepage from the bedrock aquifer and surrounding strata, and infiltration from Belleau Creek, and surface impoundments in the area.

L. The Plant regionally lies in the Dissected Till Plains physiographic province which is gently undulating, with altitudes ranging from 500 to 700 feet. The Plant lies at an altitude of approximately 450 to 500 feet above mean sea level.

M. At the Plant, Respondent manufactures semiconducting silicon wafers, using such processes as crystal growing, cutting, etching, polishing, washing, and packaging the silicon wafers.

N. Groundwater from the deep sandstone aquifers beneath the Plant has been used for manufacturing purposes and water use

continues today. The water is produced from four production wells. The Plant's potable water supply is obtained from on-site wells.

O. Reverse Osmosis reject, cooling tower blowdown, treated groundwater and other non-contact waters resulting from the manufacturing operations conducted at the Plant are treated along with storm water runoff in surface impoundments prior to discharge to Belleau Creek. The discharge of this treated wastewater is currently regulated under an NPDES permit issued by the State of Missouri. Process and sanitary waste waters are discharged directly to the O'Fallon Publicly Owned Wastewater Treatment Facility under an Industrial Pretreatment Permit issued by the City of O'Fallon.

P. A timely notification was made to EPA pursuant to Section 3010 of the RCRA, 42 U.S.C. § 6930, regarding the generation and treatment, storage or disposal of hazardous waste at the Plant. EPA assigned identification number MOD001700673 to the Plant.

Q. A timely filing of Part A of a RCRA permit application was made for the Plant to EPA. This application has been updated several times. All of the following hazardous wastes were reported on these Part A applications, but not all hazardous wastes were actually generated, stored, or treated at the Plant:

Hazardous Waste	Waste Number
1. Spent halogenated solvents	F001
2. Spent halogenated solvents	F002

3.	Spent non-halogenated solvents	F003
4.	Spent non-halogenated solvents	F005
5.	Ethylenediamine*	P053
6.	Acetone	U002
7.	Asbestos*	U013
8.	Dichloromethane (Methylene Chloride)	U080
9.	Hydrofluoric acid	U134
10.	Methanol	U154
11.	1,1,1 Trichloroethane	U226
12.	Trichloroethylene (Trichloroethene)	U228
13.	Xylene	U239
14.	Ignitable	D001
15.	Corrosive	D002
16.	Arsenic	D004
17.	Chromium	D007
18.	Lead	D008

* Wastes removed from RCRA listing.

R. A number of solid waste management units (SWMUs) are located at the Plant, including the following:

1. North surface impoundment, which is identified as area number 3 on Attachment I, is a RCRA regulated surface impoundment which received acidic and basic process wastes.

2. South surface impoundment, which is identified as area number 3 on Attachment I, received various hazardous waste and hazardous constituents, including waste waters containing

such halogenated organics as 1,1,1-trichloroethane, methylene chloride, trichloroethylene, and Freon.

3. Polishing lagoons, which is identified as area number 1 on Attachment I, consisted of three unlined lagoons, which prior to 1985, received treated effluent from the Plant's wastewater treatment system containing low levels of various volatile organics.

4. Sludge lagoons, which are identified as area 2 on Attachment I, which receive solids from the Plant's wastewater treatment system.

5. Former wastewater process lagoons, used in the early 1960's, are identified as area 4 on Attachment I.

6. Former sand filters used in the early 1960's, which are identified as area 21 on Attachment I.

7. Storage area number 7, which is identified as area number 5 on Attachment I, was used to store arsenic contaminated materials in sealed metal containers from cleanup of production areas.

8. Central storage area, which is identified as area number 6 on Attachment I, is used to store various organic solvents and waste oils.

9. D Street Storage Area, which is identified as area number 7 on Attachment I,was used in the 1960's and 1970's to store waste oils, spent solvents and empty drums.

10. Modification Building Storage Area, which is identified as area number 9 on Attachment I, was used until 1985 to store waste oils and spent solvents.

11. Waste Oil Staging Area, which is identified as area number 12 on Attachment I, is used for storing waste oil.

12. Staging Area West of Crystal Pulling, which is shown as area number 11 on Attachment I, was used until April 1989 to store spent trichloroethane.

13. Solvent Storage Area Number 5, which is shown as area number 13 on Attachment I, is used for the storage of waste solvents and alcohols.

14. Container Storage Area Number 6, which is identified as area number 14 on Attachment I, was used until 1985 for the storage of various waste materials, including 1,1,1-trichloroethane, methylene chloride, and trichloroethylene.

15. Polishing Building Staging Area, which is identified as area number 15 on Attachment I, is used to store various wastes, including wax, solvents, such as trichloroethylene, 1,1,1 trichloroethane, and methylene chloride, Freon, and waste oils.

16. East Drum Washing Station, is identified as area 16 on Attachment I, was used until 1980 for washing of drums which had been emptied but not cleaned which previously contained a variety of materials, including trichloroethylene, acetone, and 1,1,1-trichloroethene.

17. South Drum Washing Station, which is identified as area number 17 on Attachment I, is used for washing drums which had been emptied but not cleaned which previously contained various materials. The practice of washing empty drums containing halogenated organics was discontinued in 1984. This practice took place for a period of about 4 years.

18. Former Above-ground Tank, which is shown as area number 18 on Attachment I, was used for a few months in the early 1970s for storage of various materials, including methylene chloride and Freon.

19. Neutralization Tanks, which are shown as area number 19 on Attachment I, are used to treat waste waters containing acids (hydrochloric, nitric or sulfuric) and caustics (calcium hydroxide, sodium hydroxide and potassium hydroxide).

20. Treatment tanks, which are identified as area number 20 on Attachment I, are used to treat wastewater containing chromium and hydrofluoric acid.

21. Drum storage area, which is identified as area number 8 on Attachment I, was used during the last half of 1975 and for the first half of 1976 for the storage of waste oil and spent solvents.

S. Process sewer leaks may also be sources of hazardous wastes or hazardous constituents released into the environment.

T. The air stripper unit treating groundwater which is identified as area number 22 on Attachment I releases volatile organics to the air.

U. Other areas on the Plant where hazardous wastes and constituents have been detected include a former pond, which was found to contain 1700 parts per billion trichloroethylene, and a marsh area to the west of the Plant, which was found to contain up to 1900 parts per billion trichloroethylene.

V. During the 1960's and 1970's, solvents, which when spilled would be hazardous wastes and which contained hazardous constituents, may have been spilled at locations where Plant employees filled 5 gallon drums with solvents for use in manufacturing processes at the Plant. Two such locations are the "Solvent Storage Building Number 5", and the "Container Storage Area Number 6," as identified above.

W. The Plant was in existence and in operation on November 19, 1980. By submitting to EPA both a notification of hazardous waste activity and a Part A permit application, Respondent achieved interim status for the Plant pursuant to Section 3005(e) of the RCRA, 42 U.S.C. § 6925(e).

X. A groundwater monitoring system has been installed at the Plant. This system consists of 63 sample points, including 18 RCRA wells. Samples are collected from these wells on a regular basis and analyzed for volatile organic constituents. Results of historical groundwater sampling have shown the presence of trichloroethylene, vinyl chloride, freon (trichlorotrifluoroethane), 1,1,1-trichloroethane, 1,2-dichloroethylene, and, methylene chloride.

Y. Soil samples were analyzed at some monitoring well locations using an on-site VOA analyzer. An extensive soil sampling survey has not been conducted to verify the locations of areas suspected of having soils contaminated with organic solvents.

Z. In 1985, a groundwater pumping program was initiated for the purpose of limiting groundwater and contaminant migration away from the Plant. The extracted groundwater is treated by air stripping, treated in the Plant's wastewater treatment system and discharged to Belleau Creek under an NPDES permit issued by the State of Missouri.

AA. Since 1985, the following hazardous constituents were found in the water produced from the Plant's recovery wells in 1987 up to the concentrations shown below (all concentrations are in parts per billion (ppb)):

Contaminant	Concentration
1. Vinyl Chloride	71,499
2. 1,2 Dichloroethylene	600,000
3. Trichloroethylene	343,000

AB. The hazardous waste and constituents detected in groundwater at the Plant include materials which are known human and probable human carcinogens. Based on Office of Drinking Water Health Advisories the concentrations of vinyl chloride, 1,2-trans-dichloroethylene, and trichloroethylene found in groundwater at this Plant greatly exceed acceptable levels in drinking water.

V. CONCLUSIONS OF LAW AND DETERMINATIONS

Based on the foregoing findings of fact, and after consideration of the administrative record, the Director, Waste Management Division, EPA Region VII, has made the following determinations:

A. Respondent is a "person" within the meaning of Section 1004(15) of RCRA, 42 U.S.C. § 6903(15).

B. Respondent is the owner or operator of a facility that has operated and is operating subject to the requirements of Section 3005(e) of RCRA, 42 U.S.C. § 6925(e).

C. Certain wastes and constituents thereof found at the Plant are hazardous wastes and hazardous constituents thereof as defined by Section 1004(5) of RCRA, 42 U.S.C. § 6903(5). These are also hazardous wastes or hazardous constituents within the meaning of §§ 1004(5) and 3001 of RCRA, 42 U.S.C. § 6921 and 10 C.S.R. 25-3.260(1) and 4.261(1), which incorporated by reference 40 C.F.R. Parts 260 and 261, respectively.

D. There is or has been a release of hazardous wastes and hazardous constituents into the environment from the Plant.

E. The actions agreed upon in this Consent Order are necessary to protect human health or the environment.

VI. WORK TO BE PERFORMED

The parties agree, and pursuant to Section 3008(h) of RCRA, 42 U.S.C. § 6928(h), Respondent is hereby ordered to perform the following acts in the manner and by the dates specified herein. All work undertaken pursuant to this Consent Order shall be

performed in a manner consistent with the Interim Measures Workplan included as Attachment II to this Consent Order, RCRA Facility Investigation Workplan, and all other Workplans developed and approved pursuant to this Consent Order; RCRA and its implementing regulations; and applicable EPA guidance documents. Relevant guidance documents include, but are not limited to, the RCRA Facility Investigation (RFI) Guidance (EPA 530/SW-87-001), RCRA Groundwater Monitoring Technical Enforcement Guidance Document (OSWER Directive 9950.1, September 1986), Test Methods For Evaluating Solid Waste (SW-846, November 1986) and Construction Quality Assurance for Hazardous Waste Disposal Facilities (EPA 530/SW-85-031, July 1986).

A. INTERIM MEASURES (IM)

1. Respondent shall implement the Interim Measures Work Plan, Attachment II, hereto, in accordance with the schedules and requirements set forth therein, and shall continue doing so throughout the effective period of this Consent Order.

2. Respondent shall collect and dispose of recovered groundwater from the groundwater recovery wells and either treat, store or dispose of it in compliance with the requirements of RCRA.

3. For each new groundwater monitoring well installed at the Plant, Respondent shall, upon completion of the well, analyze a composite groundwater sample for volatile priority pollutant. Respondent shall provide the results of these analyses, well logs, well design and construction information,

at the Plant and measures which are being or have been taken to mitigate the release of hazardous wastes or hazardous constituents at the Plant (hereinafter "Facility Background Report" or "Background Report"). The Background Report shall include the following:

a. Information as to history of ownership and operation of the Plant, solid and hazardous waste operations, treatment, storage and disposal activities at the Plant. Section I

b. Approximate dates or periods of past product and waste spills and discharges, which contained halogenated organics which are hazardous wastes or hazardous constituents, the identity of the material spilled, the amount spilled, the location at which each such material was spilled, and the action, if any, taken in response to the spill. table 2

c. A description and summary of available information regarding the nature and extent of contamination at the Plant, including the following: Section III + IV

i. Identify all possible source areas of contamination, including, regulated hazardous waste management units, solid waste management units, spill areas, and other suspected source areas of contamination, by providing the following information for each:

(a). Location of each such unit or area, including a map of the Plant depicting such source areas; Section III

(b). Quantities of solid and hazardous wastes associated with each such unit or area; table 1

along with an explanation as to how this well fits into Respondent's interim measures, to EPA within 90 days of completion of the well.

B. RCRA FACILITY INVESTIGATION (RFI)

Respondent shall complete an investigation to define the presence, magnitude, extent, direction, and rate of movement of hazardous wastes and hazardous constituents within and extending beyond the Plant boundary meeting the requirements set forth below (hereinafter "RCRA Facility Investigation" or "RFI"). This investigation shall address the release of hazardous wastes and hazardous constituents from all hazardous and solid waste management units and other source areas at the Plant to all media, including soil, air, groundwater, and surface water. The purpose of the RFI is to characterize the potential pathways of contaminant migration; to characterize the source or sources of contamination; to define the degree and extent of contamination; to identify actual or potential receptors of the contamination; and to support the development of alternatives from which a corrective measure will be selected by EPA. The RFI shall be implemented by conducting the following activities within the time period specified for each:

1. Within one hundred twenty (120) calendar days of the effective date of this Consent Order, Respondent shall submit to EPA for review and approval a report describing current conditions at the Plant which may impact on the release or migration of contaminants, the nature and extent of contamination

(c). Nature and types of hazardous waste or constituents associated with each such unit or area; and

(d). Identification of areas where additional information is necessary to characterize the nature and quantity of hazardous wastes or hazardous constituents.

ii. An assessment and description of the existing degree and extent of contamination at the Plant, by providing the following information:

(a). All monitoring data and qualitative information on locations and levels of contamination at the Plant;

(b). All potential pathways for migration of contaminants on or from the Plant, including information on geology, pedology, hydrogeology, physiography, hydrology, water quality, meteorology, and air quality at the Plant; and

(c). A description of the potential impacts on human health and the environment of contaminants present at or released from the Plant, including demography, groundwater and surface water use, and land use of affected areas.

iii. A description of all interim measures, i.e., measures taken to mitigate the release or potential release of hazardous wastes or hazardous constituents, which were undertaken at the Plant in the past or are currently being undertaken at the Plant, by providing the following information:

(a). A description of the objectives of each such measures, i.e. how the measure is mitigating a potential

threat to human health and the environment and how it is consistent with and integrated into any long term solution at the Plant;

(b). A description of the design, construction, operation, and maintenance requirements of each such measure; and

(c). If the measure is currently being implemented, the schedule for design, construction and monitoring, and a proposed schedule for reporting to EPA regarding progress towards implementation of such measure.

2. Within one-hundred fifty (150) calendar days of the effective date of this Consent Order, Respondent shall submit to EPA for review and approval a workplan for conducting a RCRA Facility Investigation (RFI Workplan), developed in accordance with the requirements of this Consent Order, RCRA, its implementing regulations, and relevant EPA guidance documents. Relevant EPA guidance documents include, but are not limited to the document entitled Facility Investigation (RFI) Guidance (EPA 530/SW-87-001).

a. The RFI Workplan shall include the following components:

i. A Project Management Plan, in which Respondent shall describe the technical approach, schedules, budget, and personnel, including the qualifications of personnel performing or directing the RFI, including contractor personnel,

and the overall management approach to be utilized in implementing the RFI.

ii. A Data Collection Quality Assurance Plan, in which Respondent shall describe all monitoring procedures and quality assurance and quality control procedures to be followed in implementing the RFI. Monitoring procedures include the techniques and procedures to be followed for all sampling, field measurements, documentation, and sample analysis performed during the RFI to characterize environmental setting, source, and contamination. These procedures must comply with the requirements of this Consent Order and ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented. The Data Collection Quality Assurance Plan shall contain the following information:

(a). A description of Respondent's data collection strategy, which shall include a description of the intended uses for the data, and the necessary level of precision and accuracy for these intended uses; a description of methods and procedures to be used to assess the precision, accuracy and completeness of the measurement data; and a description of the rational used to assure that the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition or an environmental condition.

(b). A description of the procedures to be followed in selecting appropriate sampling locations and depths; providing a statistically sufficient number of sampling sites, such that a statistically valid comparison can be made between samples, such as by using the Student's t-test; measuring all necessary ancillary data; determining which media are to be sampled; determining conditions under which sampling should be conducted; determining which parameters are to be measured and where; selecting the frequency of sampling period; selecting the types of sample and number of samples to be collected; selecting measures to be taken to prevent contamination of the sampling equipment and cross contamination between sampling points; documenting fields sampling operations and procedures; selecting appropriate sample containers; sample preservation; and maintaining proper chain-of-custody for all samples collected.

(c). A description of the procedures to be followed in selecting appropriate field measurement locations and depths; providing a statistically sufficient number of field measurements; measuring all necessary ancillary data; determining conditions under which field measurement should be conducted; determining which parameters are to be measured and where; selecting the frequency of field measurement and length of field measurements period; and documenting field measurement operations and procedures.

(d). A description of the procedures Respondent will follow in ensuring the integrity of all samples

collected during the RFI, including chain-of-custody procedures; sample storage procedures and storage times; sample preparation methods; analytical procedures; calibration procedures and frequency; data reduction, validation and reporting; internal quality control checks, laboratory performance and systems audits and frequency; preventive maintenance procedures and schedules; corrective action; and turnaround time.

iii. A Data Management Plan, which shall describe the procedures Respondent will follow to document and track investigative data and results. Respondent shall include in this plan data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. This plan shall also describe the format Respondent will use to present the raw data and conclusions of the investigation.

iv. A Health and Safety Plan, in which Respondent shall delineate the work area and describe procedures established to control access to the work area, list the key personnel and alternatives responsible for site safety, response operations, and for the protection of public health, establish site emergency procedures, establish emergency medical care for injuries and toxicological problems, and specify any routine and special training required for personnel responding to emergencies. The Health and Safety Plan shall be consistent with NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985); EPA Order 1440.1 -

Respiratory Protection; EPA Order 1440.3 - Health and Safety Requirements for Employees Engaged in Field Activities; Facility Contingency Plan; EPA Standard Operating Safety Guide (1984); OSHA regulations particularly in 29 C.F.R. §§ 1910 and 1926; State and Local regulations; and other EPA guidance as provided. Furthermore, Respondent shall describe the following in the Health and Safety Plan:

(a). The availability of resources such as roads, water, electricity, etc.;

(b). The known hazards and evaluation of the risks associated with each activity conducted;

(c). The levels of protection to be worn by personnel in the work area, decontamination procedures for personnel and equipment; and

(d). The requirements for an environmental surveillance program.

v. A Community Relations Plan, in which Respondent shall describe the methods to be used for disseminating information to the public regarding investigation activities and results. It shall describe procedures to be followed to respond to changes in the information needed to address community concerns during design, construction and operation activities. Community relations activities shall include such measures as group meetings, distribution of fact sheets on the technical status of activities, which shall vary depending on citizen interest.

b. The RFI Workplan shall be designed to obtain the following information:

i. Based on field studies and core samples obtained, structural geology and hydrogeologic cross sections showing the extent of hydrogeologic units which may be part of the migration pathways at the Plant;

ii. To characterize the soil and rock units above the water table in the vicinity of the contaminant release(s).

iii. To characterize the dispersion of treated hazardous wastes and hazardous constituents releases from the air stripper. In order to characterize the dispersion of treated hazardous wastes and hazardous constituents released from the air stripper, Respondent shall propose in the RFI Work Plan an air dispersion model. Respondent shall identify the type of air model being used to define the dispersion. Respondent shall provide the following parameters with regard to the air model: the stack height (in meters (m)), exit temperature (degrees K), exit velocity (m/sec), emissions rate (g/sec), meteorology of the area, and base elevation of the stack. A plot plan of the installation showing the location of the stripper, location of structures within 10 stack heights of the stripper stack, heights of these structures and all horizontal distances between structures shall be included in the work plan, along with a topographical map of the area showing the location of the stripper. Any other sources of hazardous constituents in the

vicinity of the stripper shall also be identified on these maps and the same information as set forth above provided for each.

iv. Information on the characteristics of the hazardous wastes and hazardous constituents present at the Plant, and the location of such wastes and constituents, including:

(a). waste type;

(b). quantity;

(c). physical form;

(d). disposition (containment or nature of deposits); and

(e). Plant characteristics affecting release (e.g., Plant security, engineered barriers), including for each source area:

(i). unit/disposal area characteristics. i.e., location of unit/disposal area, type of unit/disposal area, design features, operating practices, period of operation, age of unit/disposal area, general physical conditions, and method used to close the unit/disposal area;

(ii). waste characteristics - type of waste placed in the unit; physical and chemical characteristics; and migration and dispersal characteristics of the waste.

v. Respondent shall collect analytical data on groundwater, soil, surface water and sediment, and subsurface gas contamination in the vicinity of the Plant to characterize contamination by hazardous waste and hazardous constituents.

This data shall be sufficient to define the extent, origin, direction, and rate of movement of contaminant plumes on-site and off-site. Data shall include date, location of sampling, media sampled, concentrations found, and conditions during sampling, and the identity of the individuals performing the sampling and analysis. The following types of contamination at the Plant shall be addressed:

(a). groundwater contamination - the Respondent shall conduct a groundwater investigation to characterize any plumes of contamination at the Plant;

(b). soil contamination - the Respondent shall conduct an investigation to characterize the contamination of the soil and rock units above the water table in the vicinity of the contaminant release;

(c). surface water and sediment contamination - the Respondent shall conduct a surface water investigation to characterize contamination in surface water bodies resulting from contaminant releases at the Plant;

(d). air contamination - the Respondent shall conduct an investigation to characterize the particulate and gaseous contaminants released into the atmosphere;

(e). MEMC shall submit for EPA review surface gas study information and data. Based on EPA's review of MEMC's gas results EPA may request MEMC to conduct an investigation to characterize subsurface gases emitted from

buried hazardous waste and hazardous constituents in the groundwater;

vi. Respondent shall collect data describing the human populations and environmental systems that are susceptible to contaminant exposure from the Plant. Respondent shall conduct ecological studies necessary to identify these potential receptors. Data on observable effects in ecosystems shall also be included. The following characteristics must be identified:

(a). Current local uses and possible future uses of groundwater;

(b). Current local uses and possible future uses of surface waters draining the Plant;

(c). Human use of or access to the Plant and adjacent lands;

(d). A description of the biota in surface water bodies on, adjacent to, or affected by the Plant;

(e). A description of the ecology overlying and adjacent to the Plant;

(f). A demographic profile of the people who use or have access to the Plant and adjacent land, including, but not limited to: age, sex, and sensitive subgroups; and

(g). A description of any endangered or threatened species near the Plant.

4. Review of the RFI Work Plan shall be in accordance with Paragraph D.1. of this Article. Upon approval of the RFI

Workplan by EPA, Respondent shall conduct the RFI by completing those tasks provided for in the approved RFI Workplan. The RFI shall be conducted in accordance with the scheduled approved in the approved RFI Workplan. All sampling and analyses done after EPA approval of the RFI Work Plan shall be conducted in accordance with the Data Collection Quality Assurance Plan. All sampling locations shall be documented in a log and identified on a detailed site map.

5. Within two hundred forty (240) calendar days from approval of the RFI Workplan by EPA, Respondent shall have completed all tasks associated with the RFI and have submitted to EPA a draft RFI Report. This report shall contain results of all investigations conducted for the RCRA Facility Investigation and demonstrate that the investigative information is sufficient in quantity and quality to describe the nature and extent of contamination, the potential threat to human health and/or environment, and to support the Corrective Measures Study. The following shall be included in the report:

a. An analysis of all data obtained during the RFI regarding the nature and extent and historical data as appropriate, both horizontally and vertically, of contamination at the Plant including sources and migration pathways. The information shall describe the extent of contamination (qualitative/quantitative) in relation to background levels indicative for the area. Furthermore, the report shall indicate the level of certainty of its conclusions.

b. Proposed groundwater protection standards based on the standards set forth at Subpart F of 40 C.F.R. Part 264. A groundwater protection standard shall be developed for each hazardous constituent listed in Table 1, 40 C.F.R. § 264.94, that has been identified in the groundwater in the uppermost aquifer during either the RFI or which had been identified during prior investigations, and is reasonably expected to be in or derived from wastes from the Plant. These groundwater protection standards shall be designed to protect human health and the environment from all releases of hazardous wastes or hazardous waste constituents from the Plant.

c. Should the Respondent choose to develop and propose groundwater protection standards based on alternate concentration limits, as provided in 40 C.F.R. §§ 264.94(a)(3) and (b), the groundwater protection standard shall be designed to protect human health and the environment from all releases of hazardous wastes or hazardous constituents from the Plant. If EPA disapproves that submittal, Respondent shall develop and propose groundwater protection standards based on background levels or maximum contaminant levels. If at any time during the post-closure care or the compliance period under 40 C.F.R. § 264.96 or the compliance period of this Consent Order, a substantial threat to human health or the environment is identified, the permit or order may be modified to include a more stringent groundwater protection standard and an extended corrective action program. Respondent shall identify all

relevant and applicable standards for protection of human health and the environment.

6. Review of the draft RFI Report shall be in accordance with Paragraph D.1. of this Article. Within sixty (60) days of receipt of EPA's comments on the draft RFI Report, Respondent shall submit to EPA a final RCRA Facility Investigation Report incorporating those comments received on the draft RFI Report.

7. In performing the RFI, Respondent need not repeat or duplicate investigations previously performed at the Plant or reproduce or resubmit data or reports previously submitted to EPA or MDNR, so long as such data or reports accurately reflect current conditions at the Plant. If such data or reports are relied upon by Respondent, at the time the RFI or other report or plan, as appropriate, is submitted to EPA, Respondent shall identify the data or the report so relied upon and the date of submittal to EPA or MDNR. In the event such data or reports do not provide all information necessary to meet the requirements of the RFI, Respondent shall perform all additional investigative work required to complete these Tasks.

C. CORRECTIVE MEASURES STUDY (CMS)

Respondent shall conduct a study to develop and evaluate the corrective action alternative or alternatives and to recommend the corrective measure or measures to be taken at the Plant necessary to protect human health or the environment (hereinafter "Corrective Measures Study" or "CMS") as follows:

1. Within ninety (90) calendar days of EPA approval of the RFI Report, Respondent shall submit an initial report covering the following information (hereinafter "Initial Corrective Measures Study Report" or "Initial CMS Report"):

a. Identification and development of corrective measure alternative or alternatives, including:

i. A detailed statement of the current situation at the Plant and the known nature and extent of the contamination as documented by the RFI, the current status of any response activities or interim measures which are being or have been implemented at the Plant, and a statement of the purpose of for the response, including identification of actual or potential exposure pathways that should be addressed by corrective measures or are being addressed.

ii. A detailed, Plant-specific statement of the objectives of the corrective action, based upon public health and environmental criteria, information gathered during the RFI, EPA guidance, and any applicable Federal statutes. At a minimum, any new corrective measures concerning groundwater releases from regulated units must be consistent with, and as stringent as, the requirements of 40 C.F.R. § 264.100.

iii. An assessment of the technologies specified in the reports entitled "Final Corrective Action Report Hydrogeologic Study" and "Ground Water Corrective Action Report," dated September 21, 1984, and September 1987, respectively, and of any additional technologies which may be applicable to the

characteristics of the Plant, wastes at the Plant, and technologies being evaluated. This assessment shall include consideration of the following factors:

(a). Implementability at the Plant;

(b). Anticipated performance, including level of performance and reliability; and

(c). Ability to achieve the corrective measure objective within a reasonable time period.

iv. Identification of the corrective measure alternative or alternatives to be considered for more detailed evaluation and a statement of the basis for arriving at these alternatives. Technologies can be combined to form the overall corrective action alternative or alternatives. The alternative or alternatives developed should represent a reasonable number of options that each appears to address all site problems and corrective action objectives.

2. Within ninety (90) calendar days of EPA approval of the Initial CMS Report, Respondent shall submit for EPA review and approval a draft report describing the detailed evaluation of corrective measure alternatives and a recommendation as to the alternative or alternatives which should be selected for the Plant (hereinafter "Corrective Measure Study Report" or "CMS Report"). The CMS Report shall include the following:

a. A detailed description of each alternative, including:

i. preliminary process flow sheets;

ii. preliminary sizing and type of construction for buildings and structures; and

b. An evaluation of each corrective measure alternative, including:

i. Its anticipated effectiveness to perform intended functions, determined either through design specifications or by performance evaluation. Waste or site specific characteristics which could potentially impede effectiveness should be described as well as possible effectiveness combinations of technologies.

ii. Its anticipated useful life, by which is meant the length of time the anticipated level of effectiveness can be maintained. Each corrective measure shall be evaluated in terms of the projected service lives of its component technologies, including consideration of future resource availability.

iii. An evaluation of the reliability of each corrective measure, including:

(a). Operation and maintenance requirements, such as the frequency and complexity of necessary operation and maintenance and the availability of labor and materials to meet these requirements; and

(b). Demonstrated and expected reliability, including consideration whether the combination of technologies have been used together effectively, whether failure of one any technology has an immediate impact on receptors, and whether the

corrective measure has the flexibility to deal with uncontrollable changes at the Plant.

iv. The implementability of each new corrective measure, including:

(a). Constructability, including factors which can affect ability to construct and measures which can be taken to facilitate construction under these conditions, as well as need for permits, agreements, equipment availability, and the location of suitable off-site treatment or disposal facilities; and

(b). Time factors, such as the time to implement and time to achieve beneficial results.

(v). Its safety, including the threat posed to nearby residents, to residents utilizing private water wells or water drawn from formations overlying the Burlington-Keokuk, and to site workers;

c. An environmental assessment of each alternative, including a description of:

i. Short- and long-term beneficial and adverse effects of the alternative;

ii. Any adverse effects on environmentally sensitive areas; and

iii. Measures which could be taken to mitigate adverse effects.

d. An assessment of human health effects, including:

i. The extent to which it mitigates short- and long-term potential exposure to contamination, including residual contamination;

ii. The extent to which it protects human health both during and after implementation;

iii. A description of the levels and characteristics of the contaminants on-site, potential exposure routes, and potentially affected populations; and

iv. A description of the level of level of exposure and anticipated reduction over time.

e. An evaluation of relevant institutional concerns, including the effects of Federal, state and local environmental and public health standards, regulations, guidance, advisories, ordinances, or community relations on the design, operation, and timing of each alternative.

f. A cost estimate of each new alternative, including:

i. capital costs, including:

(a). Direct capital costs, such as the costs of construction, equipment, land and site development, and buildings and services; and

(b). Indirect capital costs, such as engineering expenses, legal fees and license or permit costs, startup and shakedown costs, and contingency allowances.

ii. Costs for operation and maintenance, including costs for the following:

(a). operating labor;

(b). maintenance materials and labor;

(c). auxiliary materials and energy;

(d). purchased services; and

(e). disposal and treatment.

These evaluations shall include summary tables for each alternative, in which tradeoffs among health risks, environmental effects and other pertinent factors shall be highlighted.

g. A recommendation as to corrective measure or measures to be selected and a description of the basis for that recommendation. This description of the basis shall include a comparison of technical, environmental and health information of the recommended measure(s) with that of other feasible alternatives.

3. Review of the CMS Report shall be in accordance with Paragraph D.1. of this Article. Within sixty (60) calendar days of receipt of EPA comments, Respondent shall submit a final Corrective Measures Study Report, incorporating said comments for EPA's review and approval.

D. SUBMISSIONS/AGENCY APPROVAL/ADDITIONAL WORK

1. The following procedure applies to the review and approval of RFI Work Plan, the draft RFI Report, the Initial CMS Report and the CMS Report, (hereinafter "Work Plan or Report"). EPA will review the Work Plan or Report and, within ninety (90) calendar days of its receipt, either approve it or provide written comments to Respondent. Any delay by EPA beyond 90 days

from receipt of a document may be a force majeure under Article XVII. However, this review time for EPA is intended to facilitate planning by Respondent and is not intended to be a basis for Respondent to avoid any requirement of this Consent Order. If EPA does not approve the Work Plan or Report as submitted, Respondent shall have sixty (60) calendar days from the date of receipt of EPA's comments to either submit a Work Plan or Report revised in accordance with EPA's comments or as otherwise agreed by the Parties, or initiate dispute resolution in accordance with this Consent Order. EPA approved reports shall be deemed incorporated into and part of this Consent Order.

2. Beginning with the month following the effective date of this Consent Order, Respondent shall provide to EPA quarterly progress reports, signed by Respondent's Project Coordinator. These reports shall be due by the twenty fifth (25th) day of the month following the end of each calendar quarter. These quarterly reports shall continue until all terms and schedules of this Consent Order have been met. These reports shall include, at a minimum, the following:

a. A description of the actions completed during the reporting period towards compliance with this Consent Order;

b. A description of all actions scheduled for completion during the reporting period which were not completed along with a statement indicating why such actions were not completed and an anticipated completion date;

c. Copies of all data and sampling and test results and all other laboratory deliverables received by Respondent during the reporting period; and

d. A description of the actions which are scheduled for completion during the following reporting period.

3. Respondent shall provide draft and final Interim Measures, RCRA Facility Investigation and Corrective Measures Study reports to EPA in accordance with the schedule contained in this Consent Order.

4. Three copies of all documents, including Workplans, preliminary and final reports, progress reports, and other correspondence to be submitted pursuant to this Consent Order shall be hand delivered or sent by certified mail, return receipt requested, to the EPA contact identified in Article XIII of this Consent Order. One copy thereof shall be transmitted in the same manner to the MDNR contact identified in Article XIII of this Consent Order.

5. All work performed pursuant to this Consent Order shall be under the direction and supervision of Respondent's Project Coordinator, designated pursuant to Article XII of this Consent Order.

6. EPA may determine that certain tasks, including investigatory work or engineering evaluation, are necessary in addition to the tasks and deliverables included in the IM Workplan or the RFI Workplan. If EPA so determines, it will request in writing that Respondent perform the additional work in

this situation and shall specify the basis and reasons for EPA's determination that the additional work is necessary. Within ten (10) calendar days after the receipt of such request, Respondent may request a meeting with EPA to discuss the additional work. To the extent agreed upon by both Parties, Respondent shall perform the additional work EPA has requested according to an EPA approved Workplan. All additional work performed by Respondent under this paragraph shall be performed in a manner consistent with this Consent Order.

VII. QUALITY ASSURANCE

A. Throughout all sample collection and analysis activities, Respondent shall use EPA-approved quality assurance, quality control, and chain-of-custody procedures as specified in the approved Workplans and Scopes of Work. In addition, Respondent shall:

1. Ensure that EPA personnel and EPA authorized representatives are allowed access, following reasonable notification by EPA to Respondent, for auditing purposes, to each laboratory and to personnel utilized by Respondent for analyses or sample collection and field work conducted pursuant to this Consent Order. Notification shall not be required for the implementation of authorities granted EPA under Section 3007 of RCRA.

2. Ensure that each laboratory utilized by Respondent for analyses perform such analyses according to the EPA methods included in "Test Methods for Evaluating Solid Waste

(SW-846, November 1986) or alternative methods approved by EPA. If methods other than EPA methods are to be used, Respondent shall submit all protocols to be used for analysis to EPA for approval at least sixty (60) days prior to commencement of analyses. If Respondent submits analytical protocols and EPA fails to either approve them or disapprove them and provide alternative protocols within sixty (60) days, any delay caused thereby may be considered a force majeure event pursuant to Article XVII.

3. Ensure that each laboratory utilized by Respondent for analysis pursuant to this Consent Order participates in a quality assurance/quality control program equivalent to that which is followed by EPA. As a part of such a program, and upon request by EPA, each such laboratory shall perform analyses of samples provided by EPA as available to demonstrate the quality of that laboratory's analytical data.

4. Use appropriate EPA guidance to evaluate all data to be used in implementing the plans required by Article VI of this Consent Order. This evaluation shall be provided to EPA as part of the plan required by Article VI of this Consent Order.

VIII. PUBLIC COMMENT AND PARTICIPATION

A. Upon approval by EPA of a Corrective Measures Study Final Report, EPA will make both the RCRA Facility Investigation Final Report (or summary thereof) and the Corrective Measure Study Final Report (or summary thereof) and a summary of EPA's proposed corrective measure and EPA's justification for proposing

selection of that corrective measure available to the public for review and comment for at least twenty-one (21) calendar days.

B. Following the public review and comment period, EPA will notify Respondent of the corrective measure selected by EPA. If the corrective measure recommended in the Corrective Measure Study Final Report is not the corrective measure selected by EPA after consideration of public comment, EPA will inform Respondent in writing of the reasons for such decision.

C. The Administrative Record supporting the selection of the corrective measure will be available for public review at the office of the Regional Hearing Clerk, USEPA Region VII, 726 Minnesota Avenue, Kansas City, Kansas 66101 from 8:30 a.m. to 4:00 p.m. on normal business days.

IX. ACCESS

A. During the effective period of this Consent Order, EPA and EPA representatives are authorized to enter and freely move about all portions of the Plant upon which any activities are being or have been conducted pursuant to this Consent Order for the following purposes:

1. Interviewing Plant personnel and contractors;

2. Inspecting records, operating logs, and contracts related to the Plant;

3. Reviewing the progress of the Respondent in carrying out the terms of this Consent Order;

4. Conducting such tests, sampling or monitoring as EPA deems necessary;

5. Using a camera, sound recording, or other documentary type equipment; and

6. Verifying the reports and data submitted to EPA by the Respondent.

B. The Respondent shall permit such persons to inspect and copy all records, files, photographs, documents, and other writings, including all sampling and monitoring data, with the exception of attorney-client communications, that pertain to work undertaken pursuant to this Consent Order.

C. Respondent may, if it so desires, provide an escort to accompany the EPA representatives during any such inspection. Respondent's failure to provide an escort shall not be a basis for denying access under this Consent Order. However, the EPA representative shall wait a reasonable time, not to exceed thirty (30) minutes, at the Plant entrance for Respondent to secure an escort.

D. EPA will, to the maximum extent possible, minimize its use of cameras, sound recording devices, and other documentary type equipment in areas where MEMC process equipment or manufacturing are present.

E. To the extent that work required by this Consent Order, or by any approved Workplan prepared pursuant to this Consent Order, must be done on property not owned or controlled by Respondent, Respondent shall use its best efforts to obtain site access agreements from the present owners of such property within thirty (30) calendar days of approval of any workplan for which

site access is required. Best efforts as used in this paragraph shall include, at a minimum, a certified letter from Respondent to the present owners of such property requesting access agreements to permit Respondent and EPA and its authorized representatives to access such property. Any such access agreement shall be incorporated by reference into this Consent Order. In the event that such access agreements are not obtained within the time set forth in this Paragraph, Respondent shall notify the EPA in writing within ten (10) calendar days of the denial for off-site access. Respondent shall indicate both the lack of agreement and the level of effort made to obtain such access agreements. In the event EPA obtains access, Respondent shall undertake EPA approved work on such property.

F. Nothing in this section limits or otherwise affects EPA's right of access and entry pursuant to applicable law, including RCRA and CERCLA.

X. SAMPLING AND DATA/DOCUMENT AVAILABILITY

A. Respondent shall submit to EPA the results of all sampling or tests or other data generated by, or on behalf of the Respondent, in accordance with the requirements of this Consent Order.

B. Respondent shall notify the EPA at least fourteen calendar days in advance of any field activities, such as well drilling, installation of equipment, or sampling. Respondent shall hold geologic samples for six (6) months, excluding geologic samples subject to laboratory analyses. Prior to

disposal of any samples, Respondent shall give EPA thirty (30) calendar days notice and opportunity to take possession of the samples. At the request of EPA, Respondent shall provide or allow EPA or its authorized representative to take split or duplicate samples.

C. Respondent may assert a business confidentiality claim covering all or part of the information submitted pursuant to this Consent Order. The information covered by such a claim will be disclosed by EPA only to the extent and by the procedures specified in 40 C.F.R. Part 2, Subpart B. Such a claim may be made by placing on or attaching to the information, at the time it is submitted to EPA, a cover sheet, stamped or typed legend or other suitable form of notice employing language such as "trade secret", "proprietary", or "company confidential". Allegedly confidential portions of otherwise non-confidential documents should be clearly identified and may be submitted separately to facilitate identification and handling by EPA. If confidential treatment is sought only until a certain date or occurrence of a certain event, the notice should so state. If no such claim accompanies the information when it is received by EPA, it may be made available to the public without further notice to Respondent. Physical or analytical data shall not be deemed confidential.

D. Information obtained by EPA about activities conducted at the Plant, other than information submitted to EPA by Respondent, will be disclosed by EPA only to the extent and by

the procedures specified in 40 C.F.R. Part 2, Subpart B. The general practice for identification of confidential business information during an inspection will be as follows. At the time of an inspection of the Plant conducted by EPA pursuant to this Consent Order, Respondent will be given the opportunity to identify any information obtained by EPA during the course of that inspection which Respondent claims is confidential business information. The information covered by such a claim will be disclosed by EPA only to the extent and by the procedures specified in 40 C.F.R. Part 2, Subpart B. EPA will disclose information obtained during inspections or in any other manner, other than by submittal by Respondent, only to the extent and by the procedure specified in 40 C.F.R. Part 2, Subpart B. No information obtained by EPA in any manner other than by submittal by or on behalf of Respondent shall be considered a response to an EPA request or demand for information.

XI. RECORD PRESERVATION

Respondent shall preserve, during the pendency of this Consent Order and for a minimum of six (6) years after its termination, all data, records and documents in its possession or in the possession of its divisions, officers, directors, and employees which relate in any way to this Consent Order or to hazardous waste management and/or disposal at the Plant. After six (6) years from the termination of this Consent Order, Respondent shall make such records not previously provided to EPA available to EPA for inspection or shall provide copies of any

such records to EPA. Respondent shall notify EPA in writing at least thirty (30) calendar days prior to destruction of any such records, and shall provide EPA the opportunity to take possession of any such records or copies of such records.

XII. PROJECT COORDINATOR

A. Respondent hereby designates Chester (Chuck) P. Gunn, Site Environmental Engineer, as its Project Coordinator. MEMC's Project Coordinator shall be responsible for overseeing the implementation of this Consent Order. All communications between Respondent and EPA, and all documents, reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Consent Order, shall be directed through the Project Coordinator and the EPA contact identified in Article XIII hereof.

B. Respondent shall provide at least ten (10) calendar days written notice prior to changing its Project Coordinator.

C. If EPA determines that activities have caused or may cause a release of hazardous waste, hazardous constituent, or a pollutant or contaminant, or a threat to human health or the environment or that Respondent is not capable of undertaking any studies or corrective measures ordered, EPA may order Respondent to stop further implementation of this Consent Order for such period of time as EPA determines may be needed to abate any such release or threat and/or to undertake any action which EPA determines is necessary to abate such release or threat.

D. The absence of the EPA contact or other EPA representative from the Plant shall not be cause for the stoppage of work.

XIII. NOTIFICATION

A. Unless otherwise specified, a total of four (4) copies of all reports, correspondence, approvals, disapprovals, notices or other submissions relating to or required under this Consent Order shall be in writing and shall be sent to the following persons:

1. Three copies to the EPA contact person, who is initially designated as:

Kenneth S. Ritchey
USEPA, Region VII
RCRA Compliance Section
726 Minnesota Avenue
Kansas City, Kansas 66101

2. One copy to the MDNR contact person, who is initially designated as:

Nicholas Di Pasquale
Director, Waste Management Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102

B. EPA and MDNR may change their designated contacts by providing written notice of the change to Respondent.

XIV. PENALTIES FOR NONCOMPLIANCE

If Respondent fails to comply with the terms and provisions of this Consent Order, EPA may commence a subsequent action to require compliance and to assess a civil penalty not to exceed

$25,000 for each day of non-compliance or issue another Consent Order.

XV. DELAY IN PERFORMANCE/STIPULATED PENALTIES

A. Unless there has been a written modification of a compliance date by EPA or an excusable delay as defined under Article XVII, "Force Majeure and Excusable Delay," in the event Respondent fails to meet a requirement of this Consent Order, Respondent shall pay stipulated penalties as set forth below. Compliance by Respondent shall include completion of an activity under this Order or a plan approved under this Order or any matter under this Order in an acceptable manner and within the specified time schedules in and approved under this Order.

1. For failure to submit the RFI Work Plan in accordance with the schedule set forth in this Consent Order:

a. For days one through day fourteen, $500 per day;

b. For days fifteen through thirty, $1500 per day; and

c. For days thirty one and thereafter, $5,000 per day.

2. For failure to implement or conduct interim measures in accordance with the Interim Measures Work Plan, Attachment II to this Consent Order:

a. For days one through day fourteen, $500 per day;

b. For days fifteen through thirty, $1500 per day; and

c. For days thirty one and thereafter, $5,000 per day.

3. For failure to submit either the draft RFI Report or the CMS Report in accordance with the schedule set forth in this Consent Order:

a. For days one through fourteen, $500 per day;

b. For days fifteen through thirty, $1500 per day; and

c. For days thirty one and thereafter, $5000 per day.

4. For failure to submit progress reports in accordance with the schedule set forth in this Consent Order:

a. For days one through fourteen, $250 per day;

b. For days fifteen through thirty, $500 per day; and

c. For days thirty one and thereafter, $1500 per day.

B. All penalties shall begin to accrue on the first day after the date that complete performance is due or a violation occurs and shall continue to accrue through the final day of correction of the noncompliance. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Order.

C. All penalties owed to EPA under this Article shall be due within thirty (30) calendar days of the violation or noncompliance. For violations continuing for longer than thirty days, said penalties shall be due each thirty days, for each thirty day period or portion thereof the violation continues. Interest shall begin to accrue on the unpaid balance at the end of the first thirty-day period.

D. All penalties shall be paid by certified or cashier's check made payable to the Treasurer of the United States, and shall be remitted to:

Mellon Bank, EPA Region VII
Financial Management Section
P.O. Box 360748M
Pittsburgh, PA 15251

All payments shall reference the name of the facility, the Respondent's name and address, and the EPA docket number of this action and shall reference that payment is being made pursuant to this stipulated penalties provision. A copy of the transmittal of payment shall be sent to the EPA Contact specified herein.

E. The stipulated penalties set forth in this Article do not preclude EPA from pursuing any remedies or sanctions which may be available to EPA by reason of Respondent's failure to comply with any requirements of this Consent Order. However, it is the intention of the Parties that, upon payment in full of a stipulated penalty due under this Consent Order, no other civil penalty will be sought by EPA for the violations for which the stipulated penalty was paid. Payment of a stipulated penalty

does not relieve Respondent of the responsibility to comply with this Consent Order.

F. Deadlines for completion of requirements which are the subject of stipulated penalties under this Article may be extended by mutual agreement of the Parties in accordance with Article XXII, Subsequent Modification. Furthermore, EPA may, at its discretion, waive any stipulated penalties which may be due under this provision.

XVI. DISPUTE RESOLUTION

A. If Respondent disagrees, in whole or in part, with any EPA disapproval or other decision or directive made by EPA pursuant to this Consent Order, Respondent shall notify EPA in writing of its objections and the basis therefore within ten (10) calendar days of receipt of EPA's disapproval, decision or directive. Said notice shall set forth the specific points of the dispute, the position Respondent is maintaining should be adopted as consistent with the requirements of this Consent Order, the factual and legal bases for Respondent's position, and all matters it considers necessary for EPA's determination. EPA and Respondent shall then have an additional thirty (30) calendar days from EPA's receipt of Respondent's objections to attempt to resolve the dispute. If agreement is reached, the resolution shall be reduced to writing, signed by representatives of each party and incorporated into this Consent Order. If the parties are unable to reach agreement within this 30-day period, the representatives of each party shall present their respective

positions, in writing, to the Regional Administrator. The Regional Administrator shall promptly provide a written statement of his decision to Respondent, which shall be incorporated into this Consent Order.

B. The existence of a dispute as defined herein and EPA's consideration of such matters as placed in dispute shall not excuse, toll or suspend any compliance obligation or deadline required pursuant to this Consent Order during the pendency of the dispute resolution process. However, if Respondent prevails in the dispute, deadlines directly affected by the matters in dispute shall be extended for a period of time not to exceed the actual time taken to resolve the dispute in accordance with the procedures specified herein.

C. Notwithstanding any other provisions of this Consent Order, no action or decision by EPA, including without limitation decisions of the Regional Administrator of EPA Region VII, or his designee, pursuant to this Consent Order shall constitute final agency action giving rise to any rights to judicial review prior to EPA's initiation of judicial action to compel Respondent's compliance with the requirements of this Consent Order.

D. In an action by EPA to compel compliance with or otherwise enforce a requirement of this Consent Order which was the subject of dispute resolution under Paragraph A, above, Respondent may defend itself on the same bases and to the same extent it could do so in the absence of the dispute resolution section. Furthermore, in such an action, unless the dispute was

resolved by mutual agreement of the Parties, Respondent shall not be deemed to have consented to the decision of the Regional Administrator.

XVII. FORCE MAJEURE AND EXCUSABLE DELAY

A. Respondent shall perform the requirements of this Consent Order within the time limits set forth herein, unless the performance is prevented or delayed by events which constitute a force majeure. A force majeure is defined as any event arising from causes without the fault or negligence of and beyond the control of Respondent, including its consultants and contractors, which could not be overcome by due diligence and which delays or prevents performance by a date required by this Consent Order. Such events do not include unanticipated or increased costs of performance, changed economic circumstances, or normal precipitation events. Such events may include delays in securing any permits required to perform any work under this Consent Order if Respondent has made complete and timely application for such permits.

B. Respondent shall notify EPA in writing ten (10) calendar days after it becomes aware of events which Respondent knows or reasonably should know constitute a force majeure. Such notice shall include an estimate of the anticipated length of delay, including necessary demobilization and remobilization, a description of the cause of the delay and the measures taken or to be taken to minimize the delay, and an estimated timetable for implementation of these measures. Respondent shall adopt all

reasonable measures to avoid and minimize the delay. Failure to comply with the notice provision of this Section may be a basis for EPA to disapprove an extension of time based upon Respondent's assertion of force majeure.

C. If the delay has been or will be caused by a force majeure, the time for performance for that element of work and any subsequent elements of work tied to that element may be extended for a period of time necessary to overcome the effect of the delay resulting from such circumstances. Such extensions shall be in writing, and shall be accomplished through written amendment to this Consent Order pursuant to Article XXII, Subsequent Modification, or, if the schedule is contained in a work plan, by written amendment of that work plan. Such an extension does not alter the schedule for performance or completion of other tasks required by this Consent Order unless these are also specified in the amendment of the Consent Order. In the event EPA and Respondent cannot agree that any delay or failure has been or will be caused by a force majeure, or if there is no agreement on the length of the extension, this dispute shall be resolved in accordance with the Dispute Resolution provisions of Article XVI of this Consent Order.

XVIII. RESERVATION OF RIGHTS

A. EPA expressly reserves all rights that it may have, including the right to both disapprove of work performed by Respondent pursuant to this Consent Order and to request that Respondent perform tasks in addition to those stated in the

Workplans. Respondent reserves the right to oppose and defend against such requests.

B. EPA hereby reserves all of its statutory and regulatory powers, authorities, rights, remedies, both legal and equitable, which may pertain to Respondent's failure to comply with any of the requirements of this Consent Order, including without limitation the assessment of penalties under § 3008(h)(2) of RCRA, 42 U.S.C. § 6928(h)(2). This Consent Order shall not be construed as a covenant not to sue, release, waiver or limitation of any rights, remedies, powers and/or authorities, civil or criminal, which EPA has under RCRA, CERCLA, or any other statutory, regulatory or common law enforcement authority of the United States.

C. Compliance by Respondent with the terms of this Consent Order shall not relieve Respondent of its obligations to comply with RCRA or any other applicable local, state or federal laws and regulations.

D. This Consent Order shall not limit or otherwise preclude the EPA from taking any enforcement action not inconsistent with the terms of this Consent Order pursuant to § 3008(h) of RCRA or other available legal authorities should the EPA determine that such actions are warranted and necessary to protect human health and the environment. Respondent reserves the right to oppose and defend against such claims and actions.

E. This Consent Order is not intended to be nor shall it be construed as a permit. This Consent Order does not relieve

Respondent of any obligation to obtain and comply with any local, state or Federal permits.

F. EPA reserves the right to perform any portion of the work consented to herein or any additional site characterization, feasibility study, and response/correction actions as it deems necessary to protect human health and the environment. EPA may exercise its authority under CERCLA to undertake removal actions or remedial actions at any time. In any event, EPA reserves its right to seek reimbursement from Respondent for such additional costs incurred by the United States to the extent provided by law. Notwithstanding compliance with the terms of this Consent Order, Respondent is not released from liability, if any, for the costs of any response actions taken or authorized by EPA.

XIX. OTHER CLAIMS

Nothing in this Consent Order shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person, firm, partnership, or corporation for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release, or disposal of any hazardous wastes, pollutants, or contaminants found at, taken to, or taken from the Plant. No person who is not a party hereto shall be considered a third-party beneficiary to this Consent Order.

XX. OTHER APPLICABLE LAWS

All action required to be taken pursuant to this Consent Order shall be undertaken in accordance with the requirements of

all applicable local, state, and Federal laws and regulations. Respondent shall obtain or cause its representatives to obtain all permits and approvals necessary under such laws and regulations.

XXI. INDEMNIFICATION OF THE UNITED STATES

Respondent shall indemnify and save and hold harmless the United States Government, its agencies, departments, agents, and employees, from any and all claims or causes of action arising from or on account of acts or omissions of the Respondent or its agents, independent contractors, receivers, trustees, and assigns in carrying out the activities required by this Consent Order. The United States Government shall not be represented or construed to be a party to any contract entered into by Respondent in carrying out activities pursuant to this Consent Order. Respondent shall be under no duty to indemnify the United States for claims or causes of action arising from or on account of negligent, willful or intentional acts or omissions of the United States, its officers, agents, employees, contractors or any other persons acting on its behalf. Nothing herein is intended to or shall be construed as extending the liability of the United States beyond that provided by law.

XXII. SUBSEQUENT MODIFICATION

A. This Consent Order may only be amended by mutual agreement of EPA and Respondent. Such amendments shall be in writing, shall have as their effective date the date on which

they have been signed by both Parties and shall be incorporated into this Consent Order.

B. Any reports, plans, specifications, schedules, and attachments required by this Consent Order are, upon written approval by EPA, incorporated into this Consent Order.

C. No informal advice, guidance, suggestions, or comments by EPA regarding reports, plans, specifications, schedules, and any other writing submitted by Respondent will be construed as relieving Respondent of its obligation to obtain formal written approval, if and when required by this Consent Order.

XXIII. SEVERABILITY

If any provision or authority of this Consent Order or the application of this Consent Order to any party or circumstances is held by any judicial or administrative authority to be invalid, the application of such provisions to other parties or circumstances and the remainder of the Consent Order shall not affect thereby.

XXIV. TERMINATION AND SATISFACTION

The provisions of this Consent Order shall be deemed satisfied upon Respondent's receipt of written notice from EPA that Respondent has demonstrated, to the satisfaction of EPA, that the terms of this Consent Order, including any amendments hereof, but not including any continuing obligation or promises, have been satisfactorily completed.

XXV. SURVIVABILITY/PERMIT INTEGRATION

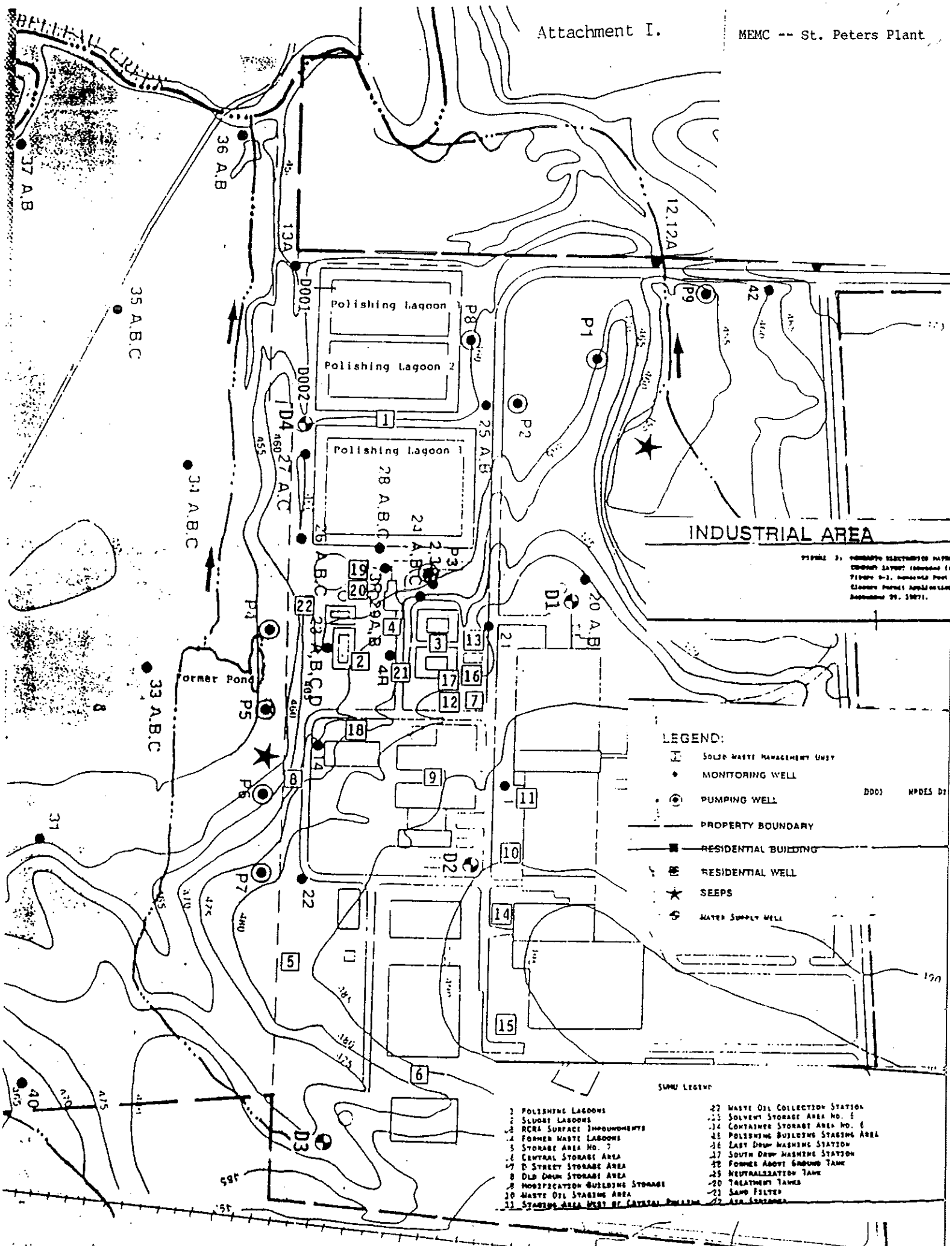
Subsequent to the issuance of this Consent Order, a RCRA permit may be issued to Respondent incorporating the requirements of this Consent Order by reference into the permit. Any requirements to this Consent Order shall not terminate upon the issuance of a RCRA permit unless the requirements are expressly replaced by requirements in the permit.

XXVI. EFFECTIVE DATE

The effective date of this Consent Order shall be the day a fully executed copy of this Consent Order is received by Respondent. Because this Consent Order was entered with the consent of both parties, Respondent waives its right to request a public hearing pursuant to § 3008(b) of RCRA, 42 U.S.C. § 6928(b) on any matter recited herein.

Attachment I.

MEMC -- St. Peters Plant



In witnesseth whereof, the Parties have affixed their signatures hereto.

For the United States Environmental Protection Agency, Region VII,

Daniel J. Shiel
Assistant Regional Counsel
U.S. Environmental Protection Agency
Region VII

9/28/89
Date

For MEMC Electronic Materials, Inc.,

Peter T. Knopf
Vice President, General Counsel and Secretary

9-27-89
Date

IT IS SO ORDERED:

David A. Wagoner
Director, Waste Management Division
U.S. Environmental Protection Agency
Region VII

9/28/89
Date

ATTACHMENT II TO CONSENT ORDER

MEMC - ST. PETERS PLANT

INTERIM MEASURES WORK PLAN

List of Figures

8/25/89
E. S. Brimer

List of Tables

List of Appendices

I. Ongoing Groundwater Corrective Action Program

A. Summary

The MEMC - St. Peters Plant sits on modified loess resting on residual clay weathered from limestone bedrock. Silt and silty loesses extend from surface to about 8 to 20 feet. The silty clay, which is weathered from the limestone bedrock, is 8 to 30 ft. lying over the weathered limestone. This cherty limestone is the first used aquifer, belonging to the Burlington-Keokuk formation of Mississippian age.

Based on hydrogeologic studies at this site between 1983 to the present, water levels range from 0 to 35 feet below surface. Results of pump and slug tests indicate low flowrates in the clayey silt and small to moderate flow in the bedrock. Typical yields in the clayey silt is less than 3 gpm while the bedrock can yield anywhere between 3 and 50 gpm. Two flow regimes appear to exist at the site. Flow in the southeast part of the plant is predominantly northwesterly while flow in the west part is to the northeast. See Figure 1 for groundwater flow.

The basis for the above identification are:

(i) well logs from monitoring and pumping wells installed onsite and water level records for these wells;
(ii) field pump and slug tests conducted on wells onsite; and
(iii) literature review of publications from the Missouri Geological Survey.

An intensive hydrogeologic investigation was initiated by the Monsanto Company in 1982. It has resulted in the installation of a site-wide monitoring well system and eight shallow pumping wells. The monitoring wells have provided information on dispersion of chemical constituents and aquifer characteristics. These wells were the basis of the installation, operation, and maintenance of the shallow pumping system. This systems is intended to alleviate the dispersion of the volatile organic constituents within the aquifer.

Several alternatives were studied as probable means for corrective action, and a groundwater pumping and treatment system was chosen. This system was implemented and started operation in April 1985.

9/20/89
E. S. Brimer

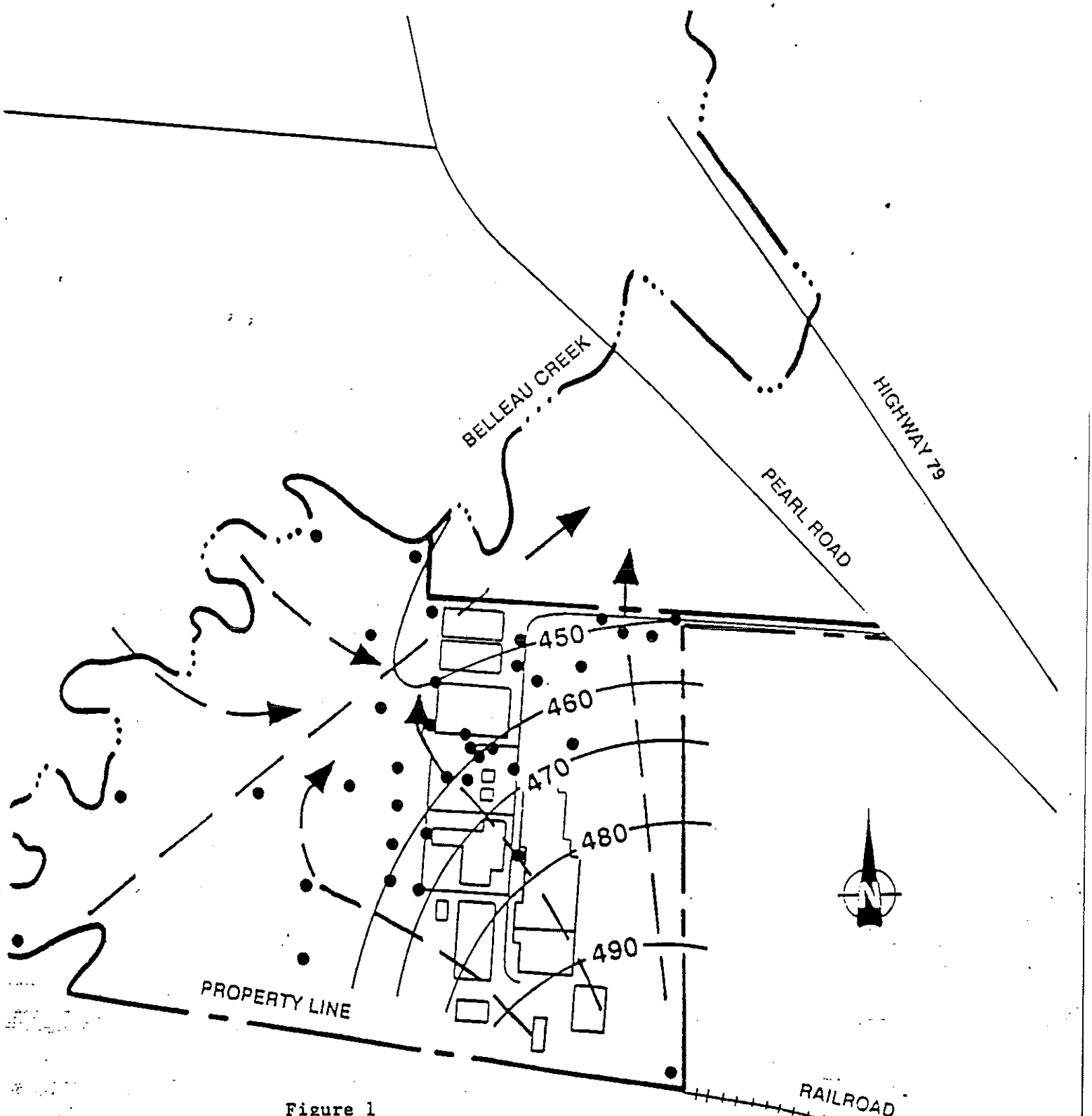


Figure 1

GENERALIZED GROUND WATER CONTOURS AND GRADIENTS (STATIC)

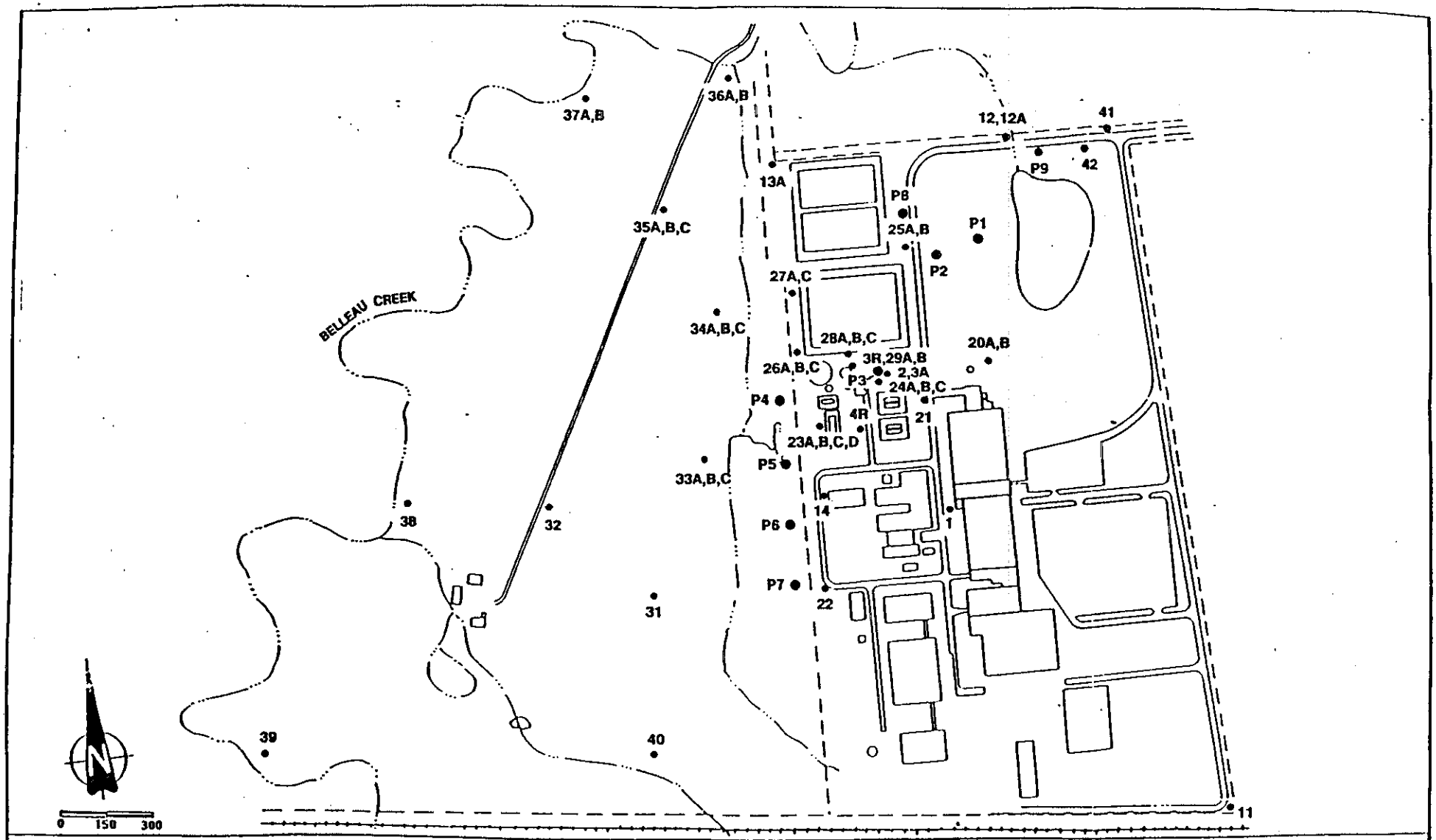


Figure 2
PUMPING AND MONITOR WELLS
GROUND WATER MONITORING
AND CONTROL SYSTEM

HYDROGEOLOGIC
INVESTIGATION

MONSANTO ELECTRONIC
MATERIALS COMPANY
ST. PETERS, MO.

I. B. Design

The basis for design of the corrective action system is fully described in Appendix 1. Essentially, it consists of a series of eight shallow pumping wells screened from 8 to 15 ft. to about 100 ft. below the surface. Pumps installed near the base of the respective well operate continuously to achieve maximum drawdown. Contaminated water is withdrawn from each pumping well and commingled into a common underground header pipe. These pumps are located downgradient of the two RCRA surface Impoundments as well as the active manufacturing site areas. Figure 2 shows the location of each pumping well. The withdrawn contaminated water is transferred to a cooling tower or air stripper tower. Here, a high air-to-water ratio removes the volatile organics. Water is then discharged into Waste Treatment, prior to discharge to Belleau Creek under a NPDES permit.

Design data for the pumping wells is given on Table 1.

Table 1 WITHDRAWAL WELL CONSTRUCTION DATA
MONSANTO ELECTRONIC MATERIALS COMPANY - ST PETERS, MO

PW#	**** COORDINATES *** NORTH	EAST	ELEV (TOC)	DEPTH (BTOC)	*** SCREEN *** DEPTH (BTOC)	LENGTH	DIAMETER	****** BEDROCK ** DEPTH (BGL)	ELEVATION	DATE INSTALLED	MATERIAL CONSTRUCT	MID-SCRN ELEVATION
P1	2643.8	5655.8	464.62	88.0	10.0	80	5	35	430	12 15 84	316L S.S.	424.62
P2	2585.9	5510.5	466.38	88.5	10.0	80	5	35	431	12 17 84	316L S.S.	426.38
P3	2268.4	5312.1	467.13	110.0	10.0	100	5	40	427	12 15 84	316L S.S.	417.13
P4	2199.0	4964.5	457.85	95.0	15.0	80	5	51	407	12 19 84	316L S.S.	417.85
P5	2005.7	4966.3	457.76	90.0	10.0	80	5	40	418	12 18 84	316L S.S.	417.76
P6	1807.2	4963.2	461.32	90.0	10.0	80	5	40	421	12 19 84	316L S.S.	421.32
P7	1614.3	4964.7	476.97	110.0	10.0	100	5	40	437	12 17 84	316L S.S.	426.97
P8	2775.0	5435.0	466.54	111.9	10.0	102	5	59	408	3 3 86	316L S.S.	415.54

I. C. Operation

The groundwater corrective action system is in continuous operation. Yield from each of the pumping wells is continuous, ranging from 1 to >24 gpm. For maximum contaminate capture and surrounding aquifer influence, the individual pumping wells are operated at the greatest drawdown consistently possible. There are no concerns about pumping the individual wells to "dryness" because:

(a) the pump motor sits below the pump stack, ensuring at least 1 foot off the bottom of the pumping well. Typically, 2 to 3 or more foot clearance from the base of the well is used to allow for solids accumulation. Thus, there is a constant minimum water level in the well.

(b) the pumps themselves are throttled (by a manual flow control valve) to correlate closely between well yield and pump output. In this way, maximum drawdown is achieved with minimum cavitation.

Collected groundwater is transferred through an underground piping header to an air stripper tower (located in the Plant's Waste Treatment area) or for cooling tower usage. For either usage, the blower (or cooling tower fan) must be in operation. As a result, the system operates continuously 24 hours per day, 365 days per year except for maintenance shutdowns (the cooling tower is only used during the summer months). Air flow is countercurrent to the direction of contaminated groundwater flow; that is, the contaminated groundwater enters the top of the air stripper tower (or cooling tower) and trickles downward through packing. Air enters at the base of the tower (motive force provided by the fan) and exhausts at the top. VOC contamination is thus air stripped from the groundwater. The water is then discharged to Waste Treatment, prior to discharge to Belleau Creek under a NPDES permit.

The groundwater contours for each calendar quarter have been provided in the Annual Groundwater Assessment Reports. The latest report was dated February 24, 1989.

I. D. Maintenance

In order to operate a corrective action system on an optimal basis, high priority is placed on maintenance. Routine maintenance activities are performed, consisting first of level and flow measurements and VOC analysis at the pumping wells, air stripper tower and cooling tower (when operating). Should these measurements and analytical results indicate a need for maintenance activities, it will then be performed. Obviously repair parts delivery schedule may result in some delay before optimal operation can be returned. Also, mobilization for some larger tasks, such as: acid cleaning of the air stripper tower; pulling and replacing a pump stack or motor; cleaning out the header piping; replacing valves, blower parts, or other equipment can require some time delay in response. As soon as the appropriate resources are available (material and manpower), the work is done. Maintenance work is planned as much as possible from the measurements and timing.

The following is a schedule of activities:

(1) Monthly adjustment of pumping well output to maximize drawdown (lowering of the groundwater surface elevation).

(2) Annual testing of piping safety relief valves or as determined to be necessary to maintain a safe pressure.

(3) Cleaning of the air stripper tower packing is done on an as-needed basis. If the air stripper tower pressure builds to an unsatisfactory level or effluent shows deterioration, the cleaning procedure will be put into effect.

(4) If the pump is no longer maintaining an adequate well drawdown, it is removed to be rebuilt, repaired, or replaced by a stocked spare pump. Alternatively, the pumping well itself may be redeveloped, acid cleaned or chlorinated (to dissolve iron and inhibit bacteria growth), etc. to reestablish its original fucntion.

(5) Pumping well maintenance response is on an as-needed, when-needed basis. A log of corrective action program activities is the record of maintenance response.

The following schedule of sampling and measurements is done:

(1) Withdrawal rates are measured at least monthly at each pumping well, at the air stripper tower, and at the cooling tower feed. The air stripper tower blower pressure is also read monthly. A typical sample worksheet is given in Figure 3.

Figure 3 CORRECTIVE ACTION SYSTEM READINGS

DATE _____ FIELD TEAM _____

Time	Reading (gal)	Calculated Flow Rate (gpm)	Time	Depth (ft)	Pump Pressure (psi) In Vault Up	Down	Remarks
P1			Static WL = 3.88 ft				
P2			Static WL = 5.13 ft				
P3			Static WL = 5.31 ft				
P4			Static WL = 4.48 ft				
P5			Static WL = 2.99 ft				
P6			Static WL = 3.06 ft				
P7			Static WL = 9.40 ft				
P8			Static WL = 14.39 ft				

AIR STRIPPER FLOWS			COOLING TOWER FLOWS			PRESSURE READINGS		
Time	Flow Total (gal)	Rate (gpm)	Time	Flow Total (gal)	Rate (gpm)	Control (psi)	Blower (inches)	Distributor Tray (inches)

NOTE: Static Water Levels Measured 6-18-86; Air Stripper Flow Control Setting (psi) _____

(2) Semi-annual analyses are done at each pumping well. Monthly analyses are done on the air stripper and cooling tower influent and effluent.

(3) The groundwater surface elevation is measured monthly at each pumping well.

I. E. Precipitation and Surface Water Influence

As discussed in Section A, the plant facility sits atop modified loess resting on residual clay weathered from bedrock. This clay layer varies from 20-30 feet around the site. The pumping wells are screened from 8 to 15 feet below grade to 88-112 feet (approximately) below grade. The top 7 to 12 feet has a bentonite seal to prevent any surface water (precipitation) influence/infiltration around the well casing itself. As a result of the well construction and surrounding soils, precipitation has no immediate effect on the pumping well output. The effect is seasonal.

Belleau Creek is located at the far west and north ends of the plant property. Its elevation is in the 445 feet MSL range on average. High precipitation events raise the level in Belleau Creek due to surface water runoff, while drought drops the level. Farmland immediately surrounding Belleau Creek is 450-455 feet MSL. (The plant manufacturing facilities are located at approximately 480 to 490 ft. MSL.) The pumping wells are located between approximately 458-467 ft. MSL and are above the 100 year floodplain. The pumping wells themselves are over 700 feet away from Belleau Creek (to the south), the only year-round flowing surface water. The farmland surrounding the creek also has the same predominant clay as the rest of the manufacturing site. As a result, the creek has no significant effect on pumping well output.

A small scenic lake located at the north end of the plant, within several hundred feet of pumping wells 1, 2, and 8, has not shown any effect on pumping well output or water level. Specifically, when this lake was filled or emptied, no change in well output occurred. The lake rests also upon tight clays.

Monitoring wells have not shown an immediate effect in change of water level after rainfall. All wells were installed using standard construction procedures. The boreholes were constructed using hollow stem auger drilling equipment and by approved methods, and then the wells were installed. Screens were packed with sand to approximately 2 feet above the screens, a 2-foot bentonite seal placed on top of the sand and the annulus grouted to ground surface. The integrity of these wells is maintained by a permanent 6 or 8 inch protective casing with locked covers. There is a seasonal variation in water levels; that is, dry conditions result in a gradual lowering of the water level while wet conditions result in gradually higher water levels.

I. F. Effluents Management

There are two effluents from the Groundwater Corrective Action program:

(1) treated groundwater, in which VOC's were removed by air stripping;

(2) the air emissions from the air stripper or cooling tower.

Treated groundwater is discharged to Waste Treatment via a sewer. This treated groundwater can be sent: (1) into two surface impoundments, with flow in series, and discharged through an NPDES-permitted outfall (Missouri DNR number: MO-0000299), or (2) to a pretreatment outfall (O'Fallon Industrial Waste Permit) leading to the local Publically Owned Treatment Works. Infrequently, untreated groundwater is sent to the pretreatment outfall (primarily due to maintenance requirements). At both the outfalls, the groundwater VOC contamination has been included and evaluated in the respective permits. The NPDES ("001") and Pretreatment ("OF") Outfalls both have specific VOC limitations. There have been no permit discharge violations relating to this program since its initial operation, beginning April 1, 1985.

VOC emissions are covered by the Missouri Department of Natural Resources' Air Pollution Control Program. There are no controls on the air stripper tower exhaust.

I. G. Health and Safety

1. Summary

Health and Safety are primary concerns. There are adequate precautions and preventative measures taken to ensure the health and safety of personnel working on the corrective action system.

Safety procedures follow plant standards. Specific procedures of use for the corrective action system are:

SP-006: Machinery and Electrical Lockout Procedure
SP-014: Confined Space Entry Procedure
SP-026: Fire Permit Procedure
SP-018: Testing Pressure Safety Relief Valves.

However, all procedures are in effect. Table 2 gives an index of these procedures.

Maintenance may require additional precautionary steps be taken to ensure worker safety. One specific example is acid cleaning of the air stripper tower packing to remove iron silts and carbonates build up. A copy of this procedure is given in Appendix 2. Well chlorination/acid cleaning/ redevelopment also follows strict procedures and is given in Appendix 3.

Some of the health and safety procedures detailed in the plant's safety procedures are reviewed below. The plant's safety procedures are the standards used for all work.

Table 2: MEMC-St. Peters Plant Safety Procedures Manual Index

CONTENTS

		Last-Revision-Date
SP-001	Emergency Brigade Policy and Procedure	08/86
SP-002	Fire Extinguishers	09/87
SP-003	Safety Color Code	02/87
SP-004	Isolated Area Check-In Procedure	07/88
SP-005	Care for the Injured Employee	06/88
SP-006	Machinery and Electrical Lockout Procedure	11/87
SP-007	Eye Protection Policy	01/88
SP-008	Safety Shoe Policy	08/85
SP-009	Safety Orientation of New Employees	06/87
SP-010	Accident Investigation Report	11/86
SP-011	Safety and Housekeeping Inspection Program	11/88
SP-012	St. Peters Site Safety Program	01/86
SP-013	Mechanized Motor Vehicle Operation	12/88
SP-014	Confined Space Entry Procedure	10/84
SP-015	Severe Weather Action Procedure	12/88
SP-016	Gas Cylinder Safety	08/87
SP-017	Safety Shower Standard	04/87
SP-018	Testing Pressure Safety Relief Valves	05/86
SP-019	Tank and Vessel Inspection Procedure	11/84
SP-020	First Line Supervisory Coverage Policy	09/88
SP-021	Respiratory Protection Program	07/87
SP-022	Radiation Protection Program	03/84
SP-023	Personal Protective Equipment Procedure	04/87
SP-024	Project Safety Hygiene Environment Energy Review	02/86
SP-025	Material Safety Data Sheet Procedure	12/84
SP-026	Fire Permit Procedure	01/85
SP-027	Chemical Hazard Communication (HAZCOM) Program	05/87
SP-028	Process Line Entry Procedure	08/86
SP-029	St. Peters Emergency Response Plan	02/88
SP-030	Procedure for Impairments-Fire Protection System	02/87
SP-031	Safety Work Order Procedure	02/87
SP-032	Safety Suggestion Procedure	08/87
SP-033	Job Safety Analysis (JSA) Procedure	01/86
SP-034	Employee Health and Communication Policy	11/88
SP-035	St. Peters Hearing Conservation Program	10/86
SP-036	Drummed Material Safety Procedure	07/87
SP-037	Visitor Access Control Policy	10/86
SP-038	Critical Safety Features and Devices	02/84
SP-039	Portable Ladders	07/88

Revision: 1/4/89
BJW

2. Personal Hygiene

   a. Eating, drinking, chewing gum or tobacco, taking medication, smoking, and the application of makeup is prohibited in any area except the plant's restrooms or breakrooms.

   b. No beard or facial hair may be worn by individuals working in areas that require respiratory protection. See plant procedure SP-021 for more detail.

3. Personal Protection

   a. Be familiar with and knowledgeable about standard operating safety procedures. USE YOUR COMMON SENSE.

   b. Be familiar, knowledgeable, and adhere to all instructions in the site safety plan and plant safety procedures.

   c. Identify and be aware of arrangements for emergency medical assistance.

   d. While working, consider fatigue, heat stress, and other environmental factors such as motor traffic influencing personal safety.

4. Hazard Assessment

The investigative activities to be conducted under the Safety and Health Plan include the following potential hazards:

a. Chemical Exposure: (The following is a list and concentrations of all contaminants known to be present.) Material Safety Data Sheets for these materials are in the Plant Environmental Engineering department.

Material(s)	Most Likely Route of Exposure	P.E.L.(s) (mg/m^3)
111-Trichloroethane	Inhalation, Ingestion,	1900
	Dermal Contact	
Trichloroethylene	Inhalation, Ingestion,	540
	Dermal Contact	
1-2-Dichloroethylene	Inhalation, Ingestion,	790
	Dermal Contact	

Vinyl Chloride	Inhalation, Ingestion,	2
	Dermal Contact	
Methylene Chloride	Inhalation, Ingestion,	1750
	Dermal Contact	
Freon	Inhalation, Ingestion,	7600
	Dermal Contact	
Chlorine	Inhalation	3(c)
Hydrogen Chloride	Inhalation	7(c)

b. Fire and Explosion

. Confined Spaces:

Tanks are considered confined space because of a potential lack of oxygen. Follow confined space entry procedures.

. Buried Utilities:

No excavation to be conducted without specific approval.

. Flammable Materials:

Gasoline for power equipment will be stored in proper container and never poured into a tank on a hot engine.

c. Oxygen Deficiency

. Confined Spaces:

Potential lack of oxygen within tanks. O_2 monitoring and confined space procedures to be followed.

. Asphyxiants:

No asphyxiants suspected or anticipated.

d. Ionizing Radiation

No ionizing radiation suspected or anticipated.

e. Biological Hazards

No biological hazards suspected or anticipated.

f. Physical Safety Hazards

Medium pressure water line and hoses, slipping on wet surface, tripping over hoses, etc.

g. Heat Stress

Potential heat stress scenario. Plenty of beverages and frequent breaks will be taken during hot weather. Personnel shall be aware of personal and colleague heat stress symptoms.

h. Cold Exposure

Adequate clothing will be worn during the late fall and winter seasons.

i. Noise Level

Not applicable.

5. Monitoring Procedures and Permits

Obtain from Plant Safety and Industrial Hygiene department.

a. Action Levels for Air Monitoring:

Organic Vapors:

No volatile organic materials are stored in the GWCA vaults. No organic vapor monitoring will be performed.

b. Explosimetry/Oxygen Level:

LEL > 6% - stop work
O_2 > 25% - stop work

c. Additional Air Monitoring Requirements:

Tank(s) or pits will be continually monitored with O_2/LEL while personnel are in tank.

d. Confined Space Entry Requirements: (Confined Space Entry Permit must be attached if required.)

Confined space entry permit must be completed for each day tank or pit entry is required. It must be signed by the on-site MEMC representative. Crew will review site-specific procedures with Project Supervisor. Back-up personnel will be dressed-out (ready for entry).

e. Hot Work Requirements: (Hot work permits must be attached if required.)

No hot work is expected to be performed. Plant Procedure SP-026 must be followed if hot work becomes necessary.

f. Block & Tag Verification:

Electrical supply box to be locked out and tagged.

NOTE: No overhead work to be performed within a 25 foot circumference of overhead wires.

6. Medical Monitoring

All personnel involved in site activities at the Facility are required to have completed and satisfactorily passed a baseline medical examination. Baseline examinations shall include, as a minimum, the following: medical history, general physical examination, electro-cardiogram (at physician's discretion), CBC and blood chemistry profiles, urinalysis, chest X-ray (at physician's discretion), pulmonary function testing (at physician's discretion), and other tests as determined necessary by the physician.

7. Equipment Requirements

Head/Face: hardhat, safety glasses.

Body: standard work uniform.

Respiratory: none.

Hands/Feet: gloves/steel toed work boots.

NOTE: All entry procedures to be performed using the buddy system. Back-up personnel to be dressed-out with air system in stand-by mode.

8. Incident Reporting

All incidents will be immediately reported to Environmental Engineering for reporting to Plant management and Plant Safety department. Following an accident or emergency episode, an incident report will be completed by the responsible individual in charge at the scene of the incident. Personnel that witnessed the episode will be questioned as necessary. Information to be included in the incident report will include, as a minimum, the following items:

- Name of person or persons involved
- Date and time

- Exact location
- Description
- Type of exposure suspected or nature of injury
- Nature of emergency response of medical attention received
- Witnesses/other personnel involved
- Corrective measures recommended to prevent the repeat of the incident.

All incident reports will be filed with Environmental Engineering and the Plant Safety department.

II. Groundwater Monitoring Plan

A. Pumping Wells and Air Stripper/Cooling Towers

To determine the effectiveness of the groundwater corrective action system, periodic groundwater, influents, and effluents sampling is required. The corrective action system sampling concentrates on the treatment aspects. While pumping well VOC analyses are useful in terms of delineating trends, the effectiveness in terms of capture from the surrounding aquifer is discussed in Section II.B. Also, pumping well VOC analysis are useful for mass balance calculations. More importantly, the influent and effluent analyses from the air stripper and cooling towers are needed to establish consistent VOC removal.

To maintain adequate treatment, the following frequency of VOC analyses has been established:

1. Influent and effluent samples are taken monthly for operating treatment units (air stripper tower or cooling tower). The cooling tower operates only in the summer.

2. Pumping wells (P1 through P8) are sampled semi-annually.

3. At the time of sampling, flow measurements are taken. Flow meters are located in the individual pumping well vaults as well as on the influent side of the air stripper tower and cooling tower. On a semiannual basis, meter readings are taken at the same time at the pumping wells and treatment towers. This becomes a flow balance. Coupled with VOC analysis, it becomes a VOC mass balance. It is used to correlate the laboratory analytical precision.

Should the treatment tower VOC effluent analysis show significant deterioration (> 100 ppb total VOC's), then corrective action responses will be taken. For the cooling tower, the flow will be reduced or stopped. For the air stripper tower, it will most likely require a packing (acid) cleaning, but may also mean blower troubleshooting. In the interim, flow from wells may be reduced. The current order of priority is P3, P7, P6, P5, P4, P2, P1, and P8. The need and priority will be reevaluated if the analysis shows significant deterioration.

VOC constituents analyzed are: 1,1,1-trichloroethane; trichloroethylene; 1,2-dichloroethylene; vinyl chloride; methylene chloride; and Freon (1,1,2-trichloro-, 1,2,2-trifluoroethane). The first five constituents are priority pollutants. These constituents were either the chemicals used for cleaning purposes at the MEMC-St. Peters Plant, or are their known products of natural degradation/ transformation. Sampling and analysis procedures are given in Section II.D.

II. B. Monitoring Wells

Monitoring wells' sampling is done for two reasons:

1. delineating the horizontal and vertical extent of VOC contamination
2. determining the effectiveness of the groundwater corrective action system in terms of preventing further outward contaminant migration and progress towards cleanup.

The MEMC-St. Peters site has an extensive network of monitoring wells. These wells are screened into several different geologic zones and are spread around the plant site. See Figure 2. VOC analysis from periodic sampling of the monitoring well network gives the contaminant dispersion.

For determining the effectiveness of the groundwater corrective action system, some wells are sampled on a more frequent basis. These wells lay along a line tending to be perpendicular to the predominant direction of flow , most screened into the highly permeable zone. These wells are also along the north boundary of the plant site and also monitor the outer plume boundary.

Monitoring wells sampled and the frequency of analysis are as follows:

1. Quarterly: MW's 11, 12, 12A, 13A, 23C, 23D, 29B, 31, 33C, 35C, 40, 41
2. Semi-Annually: MW's 27A, 27C, 32, 34A, 34C, 36B, 37A, 37B
3. Annually: MW's 1, 2, 3, 20A, 20B, 22, 23A, 23B, 24A, 24C, 25A, 25B, 26A, 26C, 28A, 28C, 33A, 33B, 34B, 35A, 35B, 36A, 42

Monitoring well construction data are given in Table 3.

VOC constituents analzyed are: 111-trichloroethane; trichloroethylene; 1,2-dichloroethylene; vinyl chloride; methylene chloride; and Freon (1,1,2-trichloro 1,2,2-trifluoroethane). The first five constituents are priority pollutants. These constituents were either chemicals used for cleaning purposes at the MEMC-St. Peters Plant, or are their known products of natural degradation/transformation. Sampling and analysis procedures are given in Section II.D.

At the same time sampling of the groundwater occurs, both water level and well depths are taken. The measurements are made utilizing a steel tape, electronic measuring probe, or equivalent. These data are recorded on a field sampling logsheet. The water level data are entered into a groundwater elevation database (see Section III).

Table 3 MONITOR WELL CONSTRUCTION DATA
MONSANTO ELECTRONIC MATERIALS COMPANY - ST PETERS, MO

WELL NO	COORDINATES NORTH (feet)	EAST (feet)	ELEV (TOC)	DEPTH (BTOC)	SCREEN DEPTH (BTOC)	SCREEN LENGTH (feet)	SCREEN SLOT SIZE	SCREEN TOP (ft MSL)	SCREEN BOTTOM (ft MSL)	DIAMETER (inches)	*** BEDROCK *** DEPTH (BGL)	*** BEDROCK *** ELEVATION (feet MSL)	DATE INSTALLED	MATL CONSTR	JOINT TYPE	BOTTOM PLUG	TOP CAP	ANNUL TOP (BGL)	ANNUL BOTTOM (BGL)
1	1852.3	5516.3	485.24	18.4	13.4	5	20	471.8	466.8	4	22	463	10 20 81	PVC	Glued	PVC	PVC		3.0
2	2250.0	5315.4	466.97	15.0	10.0	5	20	457.0	452.0	4	24	443	10 20 81	PVC	Glued	PVC	PVC		4.0
3R	2271.8	5234.1	467.12	15.4	10.4	5	10	456.7	451.7	2	na	na	7 27 83	PVC	Thread	PVC	PVC	4.5	8.0
3A	2243.2	5290.3	467.45	46.6	41.6	5	20	425.9	420.9	2.5	49	418	10 21 81	PVC	Thread	PVC	PVC		
4R	2084.2	5228.5	473.95	21.4	16.4	5	10	457.6	452.6	2	32	442	8 3 83	PVC	Thread	PVC	PVC	10.5	15.0
11	749.6	6373.3	504.16	26.4	21.4	5	20	482.8	477.8	4	30	474	10 16 81	PVC	Glued	PVC	PVC		4.0
12	2967.5	5771.8	468.57	19.1	14.1	5	20	446.5	441.5	4	na	na	10 16 81	PVC	Glued	PVC	PVC		
12A	2963.3	5781.5	468.60	57.5	52.5	5	20	408.1	403.1	2.5	58	403	10 19 81	PVC	Thread	PVC	PVC		4.0
13	2533.5	5009.3	461.61	20.1	15.1	5	20	446.5	441.5	4	na	na	10 16 81	PVC	Glued	PVC	PVC		10.0
13A	2979.6	5005.8	453.96	42.4	37.4	5	20	416.6	411.6	2.5	41	413	10 20 81	PVC	Thread	PVC	PVC		14.0
14	1911.4	5091.0	472.54	13.7	8.7	5	20	463.8	458.8	4	27	446	10 19 81	PVC	Glued	PVC	PVC		3.0
21	2166.4	5447.3	482.20	31.2	21.2	10	10	461.0	451.0	2	32	451	7 13 83	PVC	Thread	PVC	PVC	16.5	19.0
22	1563.8	5074.0	485.26	41.8	31.8	10	10	453.5	443.5	2	41	445	7 14 83	PVC	Thread	PVC	PVC	23.0	26.0
29A	2282.1	5704.5	483.04	34.0	24.0	10	10	459.0	449.0	2	na	na	7 1 83	PVC	Thread	PVC	PVC	18.0	21.5
29B	2293.4	5704.0	482.35	46.4	36.4	10	10	446.0	436.0	2	33	449	7 27 83	PVC	Thread	PVC	PVC	30.5	34.0
23A	2104.8	5096.3	470.15	26.3	16.3	10	10	453.9	443.9	2	na	na	7 7 83	PVC	Thread	PVC	PVC	11.0	13.5
23B	2114.5	5097.0	470.63	47.1	37.1	10	10	433.5	423.5	2	na	na	7 6 83	PVC	Thread	PVC	PVC	30.0	33.0
23C	2122.1	5098.6	470.69	69.2	59.2	10	10	411.5	401.5	2	56	415	7 6 83	PVC	Thread	PVC	PVC	52.0	58.5
23D	2129.4	5097.6	470.63	85.6	75.6	20	10	395.0	375.0	2	na	na	10 19 83	PVC	Thread	PVC	PVC	65.0	78.0
24A	2286.3	5316.8	467.16	25.1	15.1	10	10	452.1	442.1	2	na	na	7 18 83	PVC	Thread	PVC	PVC	11.0	13.0
24B	2263.3	5325.7	467.27	36.0	26.0	10	10	441.3	431.3	2	na	na	7 18 83	PVC	Thread	PVC	PVC	28.0	23.0
24C	2244.2	5303.6	467.13	45.9	35.9	10	10	431.2	421.2	2	45	422	7 15 83	PVC	Thread	PVC	PVC	29.5	33.0
25A	2678.0	5440.7	464.31	28.6	13.6	15	10	450.7	435.7	2	na	na	7 20 83	PVC	Thread	PVC	PVC	7.0	10.0
25B	2686.7	5441.1	464.65	53.5	38.5	15	10	426.2	411.2	2	53	412	7 20 83	PVC	Thread	PVC	PVC	33.5	36.0
26A	2342.6	5008.8	465.48	31.1	16.1	15	10	449.4	434.4	2	na	na	7 26 83	PVC	Thread	PVC	PVC	9.0	12.5
26B	2331.4	5008.5	466.58	61.5	46.5	15	10	420.1	405.1	2	61	406	7 22 83	PVC	Thread	PVC	PVC	38.5	42.0
26C	2353.4	5009.2	466.18	78.2	68.2	10	10	398.0	388.0	2	na	na	11 1 83	PVC	Thread	PVC	PVC	58.0	64.0
27A	2519.7	5016.9	463.60	36.1	26.1	10	10	437.5	427.5	2	na	na	7 12 83	PVC	Thread	PVC	PVC	18.0	21.0
27B	2529.5	5017.0	464.07	51.0	36.0	15	10	428.1	413.1	2	58	407	7 11 83	PVC	Thread	PVC	PVC	27.5	32.0
27C	2519.4	5009.4	462.12	58.7	48.7	10	10	413.4	403.4	2	59	403	8 1 83	PVC	Thread	PVC	PVC	42.0	46.0
28A	2319.0	5220.5	466.50	51.5	41.5	10	10	425.0	415.0	2	53	414	10 11 83	PVC	Thread	PVC	PVC	35.2	37.7
28B	2319.9	5214.8	466.43	62.1	52.1	10	10	414.3	404.3	2	na	na	10 30 83	PVC	Thread	PVC	PVC	41.4	45.0
28C	2319.5	5208.8	466.11	87.1	67.1	20	10	399.0	379.0	2	na	na	10 30 83	PVC	Thread	PVC	PVC	60.0	63.0
29A	2272.7	5236.8	468.73	51.7	41.7	10	20	427.0	417.0	4	54	415	10 26 83	PVC/SS	Thread	SS	PVC	35.7	38.0
29B	2273.0	5234.5	469.45	162.0	142.0	20	20	327.5	307.5	4	54	415	9 10 84	PVC	Thread	PVC	PVC	131.0	134.0
31	1505.2	4532.4	475.56	75.3	65.3	10	10	410.3	400.3	2	50	424	7 19 84	PVC	Thread	PVC	PVC	49.0	52.3
32	2051.9	4173.1	455.45	72.6	62.6	10	10	392.9	382.9	2	58	396	7 20 84	PVC	Thread	PVC	PVC	57.0	59.0
33A	2021.9	4684.9	454.69	26.6	11.6	15	10	443.1	428.1	2	na	na	6 25 84	PVC	Thread	PVC	PVC	5.0	8.0
33B	2024.3	4676.1	454.83	46.3	31.3	15	10	423.5	408.5	2	45	409	6 25 84	PVC	Thread	PVC	PVC	23.5	27.5
33C	2026.5	4668.5	454.69	63.8	53.8	10	10	400.9	390.9	2	45	408	7 30 84	PVC	Thread	PVC	PVC	43.0	46.3
34A	2577.8	4778.0	454.33	38.7	23.7	15	10	430.6	415.6	2	na	na	6 20 84	PVC	Thread	PVC	PVC	18.0	21.0
34B	2580.7	4765.2	454.66	66.0	51.0	15	10	403.1	388.1	2	65	388	6 19 84	PVC	Thread	PVC	PVC	36.0	39.0
34C	2583.8	4760.2	453.97	78.8	68.8	10	10	385.2	375.2	2	65	388	7 10 84	PVC	Thread	PVC	PVC	61.0	65.0
35A	2811.8	4554.4	454.78	40.3	25.3	15	10	429.4	414.4	2	na	na	6 8 84	PVC	Thread	PVC	PVC	15.0	18.0
35B	2817.9	4556.9	454.89	67.1	52.1	15	10	402.8	387.8	2	65	388	6 8 84	PVC	Thread	PVC	PVC	34.5	37.8
35C	2805.7	4550.8	454.76	79.6	69.6	10	10	385.2	375.2	2	67	387	7 31 84	PVC	Thread	PVC	PVC	64.0	67.7
36A	3243.0	4841.7	453.11	67.1	47.1	20	10	406.0	386.0	2	65	386	6 1 84	PVC	Thread	PVC	PVC	37.0	42.0
36B	3245.3	4836.6	452.99	78.5	68.5	10	10	384.4	374.4	2	66	386	7 9 84	PVC	Thread	PVC	PVC	64.0	66.4
37A	3211.5	4329.7	454.07	61.1	41.1	20	10	413.0	393.0	2	60	393	5 23 84	PVC	Thread	PVC	PVC	27.0	38.0
37B	3216.9	4345.4	453.99	80.0	70.0	10	10	384.0	374.0	2	61	392	8 1 84	PVC	Thread	PVC	PVC	68.0	68.0
38	2030.0	3550.0	458.47	75.8	55.8	20	10	403.5	383.5	2	63	395	9 17 85	PVC	Thread	PVC	PVC	31.0	35.0
39	1158.0	3080.0	468.49	71.3	51.3	20	10	409.2	389.2	2	59	401	9 18 85	PVC	Thread	PVC	PVC	32.0	36.0
40	1050.0	4190.0	467.78	67.0	47.0	20	10	420.7	400.7	2	56	412	9 19 85	PVC	Thread	PVC	PVC	36.0	39.0
41	2966.0	6118.0	473.06	88.3	68.3	20	10	412.8	392.8	2	71	402	12 27 85	PVC	Thread	PVC	PVC	53.0	57.0
42	2922.0	5997.0	470.43	68.5	53.5	15	10	416.9	401.9	2	68	402	5 12 88	PVC	Thread	PVC	PVC	43.0	45.0

II. C. Downgradient Neighbor's Wells

To verify no effect on surrounding neighbor's drinking water wells, periodic water sampling is done. These samples are analyzed for selected VOC's. They are: 1,1,1-trichloroethane; trichloroethylene; 1,2-dichloroethylene; vinyl chloride; methylene chloride; and Freon (1,1,2-trichloro 1,2,2-trifluoroethane). These constituents were either the chemicals used for cleaning purposes at the MEMC-St. Peters Plant, or are their known products of natural degradation/ transformation. Sampling and analysis procedures are given in Section II.D.

Sampling of those wells within approximately one mile downgradient of the MEMC plant site is conducted on an annual basis (once per calendar year). Since 1983, annual sampling has been done on these wells. No constituents have been detected. A summary of all analytical drinking water VOC results has been and will continue to be forwarded to the respective neighbors.

Sampling and analysis procedures as given in Section III.D. will be followed.

II. D. Sampling & Analysis Procedures

1. Purpose

These procedures are used for the collection and analysis of representative groundwater samples from the site groundwater monitoring system, corrective action system, and surrounding neighbors wells. It is designed to ensure compliance with the RCRA 40 CFR 265.90 groundwater monitoring requirements and good sampling and analytical protocol.

2. Sample Collection

Safety glasses and gloves must be worn at all times during well sampling to prevent splashing of soil particles or potentially contaminated water into the eyes or onto the skin. Hardhats must also be worn when sampling wells located in the Wastewater Treatment Plant area. No sampling activity should be performed if it cannot be accomplished safely.

Groundwater sample collection should be accomplished in two steps: A) 1) evacuation of the stagnant, standing well volume from the monitoring well; 2) ensuring the pumping well is operating with minimum cavitation; 3) flushing the neighbor's wells cold water spigot; and B) collection of samples for analysis.

a. Standing Volume Removal

(1) Identify the monitoring well and record all applicable information on the Groundwater Sampling Logsheet (see Attachment D-1).
(2) Put on a clean pair of disposable gloves and rinse with deionized water.
(3) Rinse the first 2 or 3 feet of the electronic depth (or manual) measuring tape with deionized water. Measure and record the initial water level in the well, relative to the top of the PVC or steel casing.
(4) Calculate the volume of water in the well casing using the information and conversion factors recorded on the Groundwater Sampling Logsheet.
(5) Attach enough new polypropylene rope to the bailer to reach the bottom of the well. Alternatively, the polypropylene rope from previous sampling of a given well may be reused provided it has been stored in a clean plastic bag clearly and indelibly marked with the well identification number. The rope must be in reasonably good condition and should be checked prior to usage.
(6) Rinse the bailer and rope several times with deionized water.

(7) Begin bailing the well from the bottom, being careful to keep the rope off the ground and away from clothing.
(8) Continue bailing until three to five standing well volumes of water have been removed, or until well is bailed dry. Periodically agitate the bailer up and down to resuspend and remove any material settled in the well. All groundwater should be poured from the bailer into a five gallon bucket to measure the quantity of water removed from the well. Based on known contaminant concentrations, water from certain wells may be carried to the Wastewater Treatment Plant for disposal. (See Environmental Engineering for Instructions.)
(9) Measure and record the final water level in the well.
(10) Remove the polypropylene rope from the bailer and place it in a clean plastic bag for use during sampling of the same well. With an indelible marker, clearly label the plastic bag with the well number.
(11) Record the groundwater conditions observed (e.g. color, odor, turbidity, etc.), weather conditions, and names of field personnel on the Groundwater Sampling Logsheet. Date and sign the logsheet when complete.
(12) Repeat each of the above steps for each well to be sampled.
(13) Prior to sampling, allow the well to recharge with sufficient groundwater to permit collection of the desired sample volumes. Sampling should be done within 48 hours of evacuation. If more than 48 hours elapse between evacuation and the start of sampling, rebail the well.

b. Groundwater Monitoring Well Sampling

(1) Identify the monitoring well and record all pertinent sampling information on the Groundwater Sampling Logsheet.
(2) Cut a slit in one side of a plastic sheet and slip it over and around the well, creating a clean surface on which the sampling equipment can be placed.
(3) Remove the sample bottles from their transport containers and prepare the bottles for receiving the samples. Make sure all bottles are labelled with the sample (well) number, date of sampling, analyses required, and the type of preservation. (Labels should be covered with transparent, waterproof tape.) Sample bottles should be kept closed until they are ready to receive the groundwater sample. Arrange the sample containers to allow for convenient filling. Always fill the containers for volatile organic analysis first.

(4) Put on a clean pair of disposable gloves and rinse with deionized water.
(5) Rinse the first 2 or 3 feet of the electronic depth (or manual) measuring tape with deionized water. Measure and record the initial water level in the well, relative to the top of the PVC or steel casing.
(6) Remove from the plastic bag, the same rope used in this well for standing volume removal and attach it securely to the bailer.
(7) Rinse the bailer and the rope several times with deionized water.
(8) Initiate sampling by lowering the bailer slowly into the well, taking care to submerge it only far enough to fill it completely. Avoid "slapping" the water surface. Minimize agitation in the well.
(9) Collect a groundwater sample from the first bailer for VOC's. Carefully pour the bailer contents into the sample bottle so as to minimize aeration. Fill the bottle until full and a standing meniscus is formed. Place and tighten the bottle cap, minimizing sample loss. Turn the bottle upside down and tap it to release any bubbles collected the cap. If none are visible, proceed with collecting groundwater samples for other analyses. If bubbles are visible, restart the sampling by adding fresh groundwater. No head space should remain in the container when full.
(10) Fill each remaining sample bottle, then return it to its proper transport carrier. Sample bottles here must be new (clean) containers, either hard plastic or glass, appropriate for the test analyses. Measurement of pH, specific conductivity, and temperature are made onsite in clean beakers with a portion of the collected liquid sample. All samples should be promptly preserved according to standard EPA protocol (see Attachment D-2). (Note: Chemical preservatives may be added to the sample bottles prior to adding the sample.) Samples that require refrigeration (4 degrees C) should be placed in ice chests with water or "Blue" ice. The caps of all filled sample bottles should be sealed with tape to prevent loosening during transport and as a means of detecting tampering.
(11) Record the number and type of samples collected on the Groundwater Sampling Logsheet. Promptly complete a Sample Chain-of-Custody Record for each sample collected.
(12) When sampling is complete, replace the well cap and lock the outer protective casing.

(13) Dispose of the polypropylene rope, gloves, and plastic sheeting. The polypropylene rope may be used for future sampling of the specific well, if it is in good condition. Store the rope in a clean plastic bag clearly and indelibly marked with the well identification number. The bailer may be reused following at least a triple rinse with deionized water.
(14) Record the groundwater conditions observed (e.g. color, odor, turbidity, etc.), weather conditions, and names of sampling personnel on the Groundwater Sampling Logsheet. Date and sign when the logsheet is complete.
(15) Proceed to the next sampling location.

c. Pumping Well, Air Stripper Tower, and Cooling Tower Sampling

(1) At the pumping well, check to see that minimum cavitation is occurring. This is readily apparent by: (a) the lack of "spitting" at the sample tap, or (b) watching the flowmeter dial stop, then start again. If necessary, throttle back on a valve to generate a more even flow.
(2) Identify the pumping well, cooling tower, or air stripper tower and record all pertinant sampling information on the logsheet.
(3). Remove the sample bottles from their transport containers and prepare the bottles for receiving the samples. Make sure all bottles are labelled with the sample (well) number, date of sampling, analyses required, and the type of preservation. (Labels should be covered with transparent, waterproof tape.) Sample bottles should be kept closed until they are ready to receive the groundwater sample. Arrange the sample containers to allow for convenient filling. Always fill the containers for volatile organic chemicals (VOC's) analysis first.
(4) Put on a clean pair of disposable gloves and rinse with deionized water. If wearing a pair already, make sure they are clean.
(5) For pumping wells, rinse the first 2 or 3 feet of the electronic depth measuring tape (or equivalent) with deionized water. Measure and record the initial water level in the well, relative to the top of the steel casing.

(6) Collect a groundwater sample from the pumping well, cooling tower, or air stripper tower. Carefully open the sampling tap and pour contents into the sample bottle so as to minimize aeration. Fill the bottle until full or a standing meniscus is formed. Place and tighten the bottle cap, minimizing sample loss. Turn the bottle upside down and tap it to release any bubbles collected around the cap. If none are visible, proceed with collecting groundwater smaples for the other analyses. If bubbles are visible, restart the sampling by adding groundwater sample. No head space should remain in the container when full.

(7) Fill each remaining sample bottle, then return it to its proper transport carrier. Sample bottles here must be new (clean) containers, either hard plastic or glass, appropriate for the test analsyes. All samples should be promptly preserved according to standard EPA protocol. See Attachment D-2. (Note: Chemical preservatives may be added to the sample bottles prior to adding the sample.) Samples that require refrigeration (4 degrees C) should be placed in ice chests with water on "Blue" ice. The caps of all filled sample bottles should be sealed with tape to prevent loosening during transport and as a menas of detecting tampering.

(8) Record the number and type of samples collected. Promptly complete a Sample Chain-of-Custody Record for each sample collected.

(9) When sampling is complete, close the sample port and sample vault and lock the vault (on pumping wells).

(10) Proceed to the next sampling location.

d. Neighbors' Wells Sampling

(1) Identify the cold water spigot (if inside the residence) or an outdoor spigot.

(2) Remove the sample bottles from their transport containers and prepare the bottles for receiving the samples. Make sure all bottles are labelled with the sample (well) number, date of sampling, analyses required, and the type of preservation. (Labels should be covered with transparent, waterproof tape.) Sample bottles should be kept closed until they are ready to receive the groundwater sample. Arrange the sample containers to allow for convenient filling.

(3) Put on a clean pair of disposable gloves and rinse with deionized water. If wearing a pair already, make sure they are clean.

(4) Collect a groundwater sample from the sample tap for VOC's. Carefully open the sample tap and pour the contents into the sample bottle so as to minimize aeration. Fill the bottle until full or a standing meniscus is formed. Place and tighten the bottle cap, minimizing sample loss. Turn the bottle upside down and tap it to release any bubbles collected around the cap. If none are visible, proceed with collecting groundwater samples for the other analyses. If bubbles are visible, continue adding groundwater sample. No head space should remain in the container when full.

(5) Fill each remaining sample bottle, then return it to its proper transport carrier. Sample bottles here must be new (clean) containers, either hard plastic or glass, appropriate for the test analsyes. All samples should be promptly preserved according to standard EPA protocol. See Attachment D-2. (Note: Chemical preservatives may be added to the sample bottles prior to adding the sample.) Samples that require refrigeration (4 degrees C) should be placed in ice chests with water on "Blue" ice. The caps of all filled sample bottles should be sealed with tape to prevent loosening during transport and as a menas of detecting tampering.

(6) Record the number and type of samples collected. Promptly complete a Sample Chain-of-Custody Record for each sample collected.

(7) When sampling is complete, be sure to turn off the tap. Proceed to the next sampling location.

3. Sample Preservation and Shipment

Samples usually contain one or more unstable components that require immediate analysis or preservation. Preservation techniques (refrigeration, pH adjustment, and chemical treatment) are employed to minimize the influence of temperature, pH, bacterial action, and intermolecular reactions on the pollutant concentrations. All groundwater samples must be promptly and properly preserved as they are collected. Preservation methods should conform to standard EPA protocol. See Attachment D-2 for a list of the proper preservation methods for specific analytes.

Because the majority of analyses are performed by off-site contract laboratories, proper sample transport or shipment is very important. Several considerations should be made prior to shipment to ensure samples will be representative, intact and traceable when they arrive at their destination.

a. Maintaining Sample Integrity
The primary method of ensuring sample integrity is through proper preservation procedures. If preservation by refrigeration is necessary, samples should be packaged with "Blue" or water ice such that the proper temperature is maintained throughout the transport period. The allowable holding time for each type of sample must also be considered when choosing the method of shipment (e.g. private automobile, U.P.S., Federal Express, etc.).

b. Sample Packaging
Care must be taken when packaging samples to ensure that all sample containers arrive intact. When samples are shipped in glass containers, special packing techniques should be employed to reduce shock and bottle contact and vibration. Where samples are shipped via commercial carrier, the shipping container is sealed (e.g. with tape) to allow the receiver to detect any tampering.

c. Chain-of-Custody
Samples should be packaged and shipped in a manner to ensure sample Chain-of-Custody is maintained. (See Section D-5.) The person taking possession of the samples must sign and date the Sample Chain-of-Custody Record sheet for the specific samples received. When the receiver refuses to sign for the sample(s), as in the case of commercial carriers such as U.P.S. or Federal Express, the time and identifying shipment number (e.g. Airbill No.) should be recorded to trace sample history.

4. Analytical Procedures

All groundwater samples should be analyzed according to the EPA standard protocols set forth in EPA SW-846, Test Methods for Evaluating Solid Wastes, November, 1986. See Attachment D-3 for compound specific analytical method. When these methods are either not possible or inappropriate, an equivalent method may be employed if it is analytically sound, produces statistically reproducible results, and meets all regulatory requirements for analytical method substitution. Note: No alternate methods are to be employed without express permission by MEMC and any necessary regulatory approval.

5. Chain-of-Custody

Sample Chain-of-Custody is the recorded history which ties a specific sample to a specific reported result. The objective of the Chain-of-Custody procedures is to create an accurate written record which can trace the possession, handling, and treatment of a sample from the time it was collected, through shipping, analysis, and reporting of results. A person is said to have "custody" of a sample if:

a. they have physical possession of the sample,
b. the sample is in their view, after being in their possession,
c. they have locked up the sample to prevent tampering, or
d. they have placed the sample in a secure area, restricted to authorized personnel only.

Sample Chain-of-Custody should be documented either by a single formal record sheet (see Attachment D-4) or by a series of records such as field logbook, transportation receipts, laboratory sample logbook, etc.. The standard Sample Chain-of-Custody Record sheet is the preferable method. Instructions for its use are found on the reverse side of the form.

6. Quality Assurance

To ensure accurate analytical results, replicates are run on several constituents. Random selections of groundwater sample duplicates are taken during the sampling phase. These are labelled as numbered well samples with the coding kept separate for blind results. Analyses are then made on selected constituents in the sample duplicates. The analytical results from the identified and coded well samples are then compared for accuracy. A blank is taken of ultrapure water to check for background contamination of sampling containers.

Laboratory quality assurance is to follow the program described in Chapter 16, Addendum to Handbook for Sampling and Sample Preservation (EPA 600/4-83-039, August 1983, Environmental Monitoring and Support Laboratory).

ATTACHMENT D-1

GROUNDWATER SAMPLING LOGSHEET

Monitoring Well # _____

STANDING VOLUME REMOVAL

Date _____

Names of Field Personnel: _____

Time

Well SEAL Serial No. _____ Was SEAL Broken? _ Yes _ No

Well Depth _____ ft Diameter of Well _____

_____ Depth to Water (Initial) _____ ft Groundwater Elevation (MSL) _____

Length of Water Column _____ ft Standing Well Volume _____ gal

2" Casing = 0.16 gal/ft; 2}" Casing = 0.25 gal/ft; 4" Casing = 0.66 gal/ft

_____ Began Evacuation Method of Removal _____

Number of Bailers Removed _____ or Minutes Pumped _____ @ _____ gpm

Volume Expelled _____ gal

Was Well Bailed Dry? _____

_____ Depth to Water (Final) _____ ft

Water Conditions: _____

Weather: _____

Remarks/Observations: _____

Signature(s) Asserting Accuracy of Field Data: _____

GROUNDWATER SAMPLING

Date _____

Names of Sampling Personnel: _____

Time

_____ Depth to Water (Initial) _____ ft Groundwater Elevation (MSL) _____

_____ Began Sampling Method of Collection _____

	Sample Type	Container Type
Samples Collected		

_____ Finished Sampling

_____ Depth to Water (Final) _____ ft

New Well SEAL Serial No. _____

On-Site Analyses:

Time	1	2	3	4	Signature
pH					
Spec. Cond.					
Temperature					

Instruments Used: pH _____ Buffers _____

Spec.Cond. _____ Standard _____

Water Conditions: _____

Weather: _____

Remarks/Observations: _____

Signature(s) Asserting Accuracy of Sampling Data: _____

GROUNDWATER SAMPLING AND ANALYSIS

PRESERVATION AND MAXIMUM HOLDING TIMES

COMPOUND	*CONTAINER	PRESERVATION	MAXIMUM HOLD TIME
1,1,1-Trichloroethane	G	4 drops conc. HCl Cool, 4 degrees C	14 days
Trichloroethylene	G	4 drops conc. HCl Cool, 4 degrees C	14 days
Methylene Chloride	G	4 drops conc. HCl Cool, 4 degrees C	14 days
1,2-Dichloroethylene	G	4 drops conc. HCl Cool, 4 degrees C	14 days
Vinyl Chloride	G	4 drops conc. HCl Cool, 4 degrees C	14 days
1,1,2-trichloro 1,2,2-Trifluoroethane	G	4 drops conc. HCl Cool, 4 degrees C	14 days

* CONTAINERS: G = Glass with teflon-faced silicone septum

Reference: EPA SW-846, Test Methods for Evaluating Solid Waste, Volume 1B, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, November, 1986 (Third Edition).

ATTACHMENT D-3

SUMMARY OF
GROUNDWATER MONITORING ANALYTICAL METHOD REFERENCES

1,1,1-Trichloroethane Trichloroethylene Methylene Chloride 1,2-Dichloroethylene 1,1,2-Trichloro- 1,2,2-Trifluoroethane Vinyl Chloride	EPA SW-846, Test Methods for Evaluating Solid Waste, Volume 1B, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, November, 1986 (Third Edition).

8/25/89
E. S. Brimer

SAMPLE CHAIN-OF-CUSTODY RECORD

Monsanto Company - St. Peters Plant

ATTACHMENT D-4

SAMPLING RECORD

Sample Identification	Date/Time	Sampled by (signature)	No. of Containe

Custody Relinquished to (signature): _____ Date/Time: _____

CARRIER RECORD

Sample(s) Carried by (signature): _____ Date/Time: _____

LABORATORY RECORD

Lab #1 _____

Sample(s) Received by (signature): _____ Date/Time: _____

Sample Identification	Relinquished to (signature)	Date/Time Analyzed	Analyses Performed

Lab #2 _____

Sample(s) Received by (signature): _____ Date/Time: _____

Sample Identification	Relinquished to (signature)	Date/Time Analyzed	Analyses Performed

REPORT OF ANALYSIS

Lab #1: Report No.s _____ Date _____ Signature _____

Lab #2: Report No.s _____ Date _____ Signature _____

III. Data Management

A. Data Collection/Storage

Data is periodically generated as a result of: (1) groundwater monitoring well measurements and VOC analyses, (2) corrective action system measurements and VOC analyses, and (3) downgradient neighbors' wells VOC analyses. All VOC analysis with QA/QC backup data are received in the original laboratory reports. These original reports are filed chronologically into folders and stored in a cabinet in Environmental Engineering's offices at MEMC-St. Peters. The groundwater monitoring corrective action system (specifically: pumping wells, air stripper influent and effluent, and cooling tower influent and effluent) VOC analytical reports are stored with the same set of data. The neighbors' wells VOC data are stored in a separate set. For easy retrieval of a report, the files are usually separated by year.

Groundwater and corrective action system measurements are kept either by a consultant hired for operations or by MEMC. The operations consultant uses a log book and records observations/ measurements (i.e. water levels, blower and pump gage pressures, etc.). He maintains the log book and occasionally photocopies pages for MEMC's use. All photocopied pages for MEMC are kept in a separate file in Environmental Engineering's offices at MEMC-St. Peters. The consultant otherwise keeps the log book until requested by MEMC.

III. B. Computer Database

Because of the extensive sampling and measurement data generated during the initial investigation, ongoing corrective action program monitoring, and periodic monitor well sampling, the data has been and will continue to be entered into a computer database. The current system used for data management is "dBase III", but this may change as technology/software improves.

Data are periodically entered into the respective file (i.e. VOC database, Groundwater Level database). These files, which are now summaries of lab reports, are used to spot trends, etc. Various report "generators" may be used to determine, for example, statistical trends or differences. If needed, a paper copy of the report is made. Data diskettes (or other media, as developed) are also used for summary. The databases have previously been given to EPA and DNR.

III. C. Reports

An Annual Groundwater Assessment Report required under RCRA will be submitted detailing:

1. Groundwater analysis and level data
2. Flow direction of groundwater , and
3. Migration and the extent of the indicator parameters.

Aquifer flow direction will be determined annually. The hydraulic conductivities have been determined previously by field pump and slug tests. These results delineated the aquifer characteristics. Flowrates and direction is determined by recording the water levels in wells screened into the aquifer. These water level data translate into hydrostatic potentials that indicate the direction of flow.

Reports will follow the current RCRA Groundwater Assessment report format. This includes a data summary (VOC results and water level measurements), groundwater contour maps, VOC contour maps, discussion of progress made during the year in VOC removal, changes in constituent concentration at individual wells and other pertinent results.

The Annual Groundwater Assessment Report will be submitted by March 1 of the following year. Quarterly status reports will be submitted in the months of February, May, August and November.

IV. Groundwater Assessment Plan

Within forty five (45) calendar days of the effective date of the Consent Order, MEMC shall submit to EPA for review and approval a groundwater assessment plan developed in accordance with the 40 C.F.R. 265.90 to 265.94. The assessment plan will include a review of all data from ground level down to the point where monitoring wells confirm the absence of contaminants.

V. New Information

In the event the MEMC obtains new information which indicates the release of hazardous waste and/or hazardous constituents at the Plant that presents a threat or potential threat to human health or the environment, or MEMC shall, without undue delay, notify EPA orally, followed with written notice within seven (7) calendar days, summarizing the immediacy and magnitude of the threat to human health or the environment and the proposed response to the release to mitigate such threat. Within twenty-one (21) calendar days of notifying EPA, or MEMC shall submit to EPA an IM Workplan for approval that identifies IM which mitigate this threat and are consistent with and integrated into any long term solution at the Plant.